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frontispiece

Endemic goiter has been the focus of surveys throughout Latin America (see paper on pp. 731–737). Here, Guatemalan school children are examined.

PHR SYNOPSES

INTERDEPARTMENTAL COMMITTEE ON NUTRITION FOR NATIONAL DEFENSE: ***Suggested guide for interpreting dietary and biochemical data. Public Health Reports, Vol. 75, August 1960, pp. 687–698.***

Because present official dietary standards are not applicable to situations of stringency or limited food supply, provisional standards related to minimal needs were formulated. They are to be used to interpret the results of nutrition surveys conducted according to the methods of the ICNND Manual of Nutrition Surveys.

High, acceptable, low, and deficient levels are designated for evaluating nutrient intakes, urinary vitamin excretions, and blood constituents. High is defined as high for the prevention of recognizable clinical deficiencies, deficient as levels associated with definite physical impairment due to insufficiency of a nutrient. The data which served as a basis for setting these standards are discussed. Application of the provisional standards to survey data is expected to provide a practical appraisal of the validity of the standards themselves.

PLOUGH, IRVIN C. (Fitzsimons General Hospital, Denver), and BRIDGFORTH, EDWIN B.: ***Relations of clinical and dietary findings in nutrition surveys. Public Health Reports, Vol. 75, August 1960, pages 699–706.***

Selected data on nutrient intakes from 58 surveys in 57 military messes in 8 nations are compared with the clinical and average biochemical findings in troops from the same locations. The surveys were performed according to a standard technique under the auspices of the Interdepartmental Committee on Nutrition for National Defense.

Clinical and biochemical findings relating to vitamin C nutriture correlated well with dietary intakes. Urinary excretion rates of thiamine, riboflavin, and N'-methylnicotinamide correlated roughly with dietary intakes of thiamine, riboflavin, and niacin, respectively. However, the clinical findings widely held to reflect an insufficiency of these vitamins showed scarcely any correlation with dietary intakes.

No apparent correlations in vitamin A or calorie nutriture were found between the three survey approaches, although there was an apparent negative correlation between fat intake and serum cholesterol.

The paper identifies and discusses sources of errors in interpretation of the findings and suggests that, with appropriate recognition of the limitations of each type of evidence and appreciation of nutritional physiology, useful appraisals of nutriture are possible.

COMBS, GERALD F. (University of Maryland), and WOLFE, ALVIN C.: ***Methods used in dietary survey of civilians in Ecuador. Public Health Reports, Vol. 75, August 1960, pp. 707–716.***

Three different methods of collecting dietary intake data among the civilian population of Ecuador have been compared. These are the recipe method, the food composite analysis method, and the 24-hour recall questionnaire method. The close agreement between the data obtained by these methods established the reliability of a larger body of data obtained from 341 families by the 24-hour recall questionnaire method alone. Results obtained in this survey indicate that considerable information of a highly reliable nature can be obtained in a relatively short period of time with a minimum of skilled personnel.

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RUSSELL, ALBERT L., LITTLETON, NORMAN W., LEATHERWOOD, ERNEST C., SYDOW, GUNNAR E., and GREENE, JOHN C. (Public Health Service): ***Dental surveys in relation to nutrition. Public Health Reports, Vol. 75, August 1960, pp. 717–723.***

The dental phase of the surveys conducted by the Interdepartmental Committee on Nutrition for National Defense has revealed no consistent pattern of association between oral status and nutrition. High and low levels of caries occurred among 713 Eskimos serving in the Alaska National Guard in March 1958. Ranging from 17 to 54 years of age, they had generally low plasma levels of vitamin A and high intake of animal protein; moderate, of fat; and very low, of carbohydrates. Caries appeared less, the more isolated the home village.

Levels of caries as low or lower were seen in a geographically and ethnically representative sample of 1,089 Ethiopians in the fall of 1958, with a low-protein, high-carbohydrate cereal diet, rich in thiamine; and in the last quarter of 1959 in 3,700 Vietnamese whose staple was highly milled rice yielding little thiamine and riboflavin. In Ecuador's central Sierra, during the summer of 1959, low caries levels were found related to high fluoride intake but also occurred in the eastern jungle, with unfluoridated water. Means for the sample of 4,975, from 1 to 87 years old, differ little from expected averages for Baltimore.

Among 1,500 Peruvian servicemen studied in the spring of 1959, those from the southern Sierra had lowest caries experience, a fifth of that expected for a low-caries area in this country. A typical food there is under study as a possible caries inhibitor. Large numbers in each area group had no caries history. Periodontal disease, however, was universal, showing striking differences concomitant with variations in nutritional status.

WOODRUFF, CALVIN W. (American University Hospital, Beirut, Lebanon), and HOERMAN, KIRK: ***Nutrition of infants and preschool children in Ethiopia. Public Health Reports, Vol. 75, August 1960, pp. 724–730.***

Observations were based on questionnaires concerning dietary patterns of 133 children under 59 months and blood samples of 100 of these and 58 other preschool and school children. Of the first group, almost half were breast fed for 18 months, and more than 80 percent received supplementary cow's milk during their first year. By 2 years, all but one-fifth ate the family diet.

Analysis of capillary blood samples showed deficient levels of vitamin C in 65 percent, elevated alkaline phosphatase activity in 11 to 26 percent of the preschool group, and almost universally elevated globulin values.

Mild rickets and protein malnutrition were the most common nutritional diseases in infancy. The association of edema, marasmus, and diarrhea was frequently encountered.

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SYNOPSES

SCRIMSHAW, NEVIN S. (Institute of Nutrition of Central America and Panama, Guatemala City): *Endemic goiter in Latin America. Public Health Reports, Vol. 75, August 1960, pp. 731–737.*

A review of the literature on casefinding surveys for endemic goiter indicates that it is a significant health problem in all of Latin America. Cretinism, deafmutism, and feeblemindedness are frequently reported in association with high prevalence, but their causal relationship has not yet been confirmed.

Several studies report that salt iodized with potassium iodate resulted in a marked reduction in the prevalence of goiter among school children. The importance of salt iodization as a prophylaxis has been recognized to the extent that legislation requiring it is already in effect, but not yet enforced in all, in 9 of the 20 Latin American countries. Nearly all of the others have legislation pending.

A series of FAO–WHO nutrition conferences have recommended that for Latin America the level of iodization be not less than 1 part of iodine in 20,000 and not more than 1 part in 10,000 parts of salt. Potassium iodate is preferred because it is stable when added to crude moist salt and it requires no special refining or packaging.

DARBY, WILLIAM J. (Vanderbilt University School of Medicine), McGANITY, WILLIAM J., McLAREN, D. S., PATON, DAVID, ZAMED ALEMU, and MAKONNEN GEBRE MEDHEN: *Bitot's spots and vitamin A deficiency. Public Health Reports, Vol. 75, August 1960, pp. 738–743.*

Observations made in Ethiopia and Tanganyika in 1958–59 corroborate previously published reports showing there need be no correlation between the presence of Bitot's spots and hypovitaminosis A.

In studies of more than 1,790 school children in Addis Ababa, Ethiopia, general physical examinations, night vision testing, and determination of serum carotene and vitamin A blood levels showed no meaningful differences between children with and without Bitot's spots. Two additional small studies in Tanganyika supported these findings.

LOWENSTEIN, FRANK W. (World Health Organization): *Nutritional survey of rural families in Jequitibá, Brazil, 1957–58. Public Health Reports, Vol. 75, August 1960, pp. 744–757.*

A nutritional survey of 54 farm families was conducted in July 1957 and repeated with 50 of them 8 months later. The families were divided into three groups: (*a*) those receiving financial and technical aid from the Associação de Crédito e Assistência Rural (ACAR), (*b*) those receiving financial but no technical aid from ACAR, and (*c*) those having no contact with ACAR.

Although the three groups of families showed remarkable physical similarity, there were several striking variations in physical characteristics. There were basic differences in food patterns among the groups. Families in group 1 were superior to those in the other two groups in regard to income, some home conditions (food storage, privies, water filters), planting of vegetables and fruits, and year-round consumption of milk and beef. Correspondingly they showed a lower incidence of dryness of skin (xerosis) in July than the other two groups. This generally better situation of group 1 might be ascribed to the educational influence of ACAR. However, information on attitudes and taboos in relation to foods reflects serious problems not confined to any one group.

In a survey of this nature one cannot separate personal hygiene, sanitation, and nutrition because they all influence the level of health. Thus, any program of education by ACAR or a similar organization should be directed to raising standards in these areas.

Career Opportunities

Child Health. The University of Michigan and the University of Minnesota Schools of Public Health will hold jointly an institute on "Newer Concepts of Growth and Development: Implications in Child Health" for 5 days, November 28–December 2, 1960, in Minneapolis, Minn., sponsored by Michigan and Minnesota State maternal and child health and crippled children's programs under a grant from the U.S. Children's Bureau.

Seminars and discussions of recommendations from the 1960 White House Conference on Children and Youth, newer knowledge in growth and development and its application to health supervision of children, accident prevention, management of handicapped children, program planning and evaluation, and enlisting community support are a part of the program.

Eligibility is limited to staff members in States in Regions V and VI of the U.S. Department of Health, Education, and Welfare and immediate border States. Further information may be obtained from Dr. Donald C. Smith, associate professor of maternal and child health, University of Michigan School of Public Health, Ann Arbor, Mich., for Region V, and Dr. Gaylord W. Anderson, director, University of Minnesota School of Public Health, Minneapolis, Minn., for Region VI.

Tuberculosis. The Communicable Disease Center, in cooperation with the Division of Special Health Services, Public Health Service, will offer a course in laboratory methods in the diagnosis of tuberculosis October 31–November 11, 1960, and January 30–February 10, 1961. All grades of employed laboratory personnel approved by the State health officers are eligible, as well as laboratory directors and senior laboratory staff members. Practical laboratory training will cover all phases of tuberculosis bacteriology, including preparation in culture media, microscopy, cultural procedures, diagnostic use of animals, cytochemical techniques, and testing of drug sensitivity. Demonstration and training in techniques for the isolation and identification of atypical acidfast bacilli will also be presented. No tuition or laboratory fees are charged. Application forms may be obtained from the Laboratory Branch, Communicable Disease Center, Public Health Service Atlanta, Ga.

Radiation. The Robert A. Taft Sanitary Engineering Center, Public Health Service, is offering five courses on public health aspects of radiation during the coming months. These courses are:

Radionuclides in Foods, September 12–23, designed for professional personnel responsible for the surveillance of radioactive materials in milk and food. The course includes technical training and laboratory sessions in methods for the sampling and assay of radioactive contaminants, and discussions on procedures for data interpretation and problems in this environmental area.

Four consecutive courses, *Basic Radiological Health,* October 3–14, *Radionuclide Protection* and *Radiological Health for X-Ray Technicians,* both during the week of October 17–21, and *X-ray Protection,* October 24–28. Basic radiological health, a prerequisite for the courses in radionuclide and X-ray protection, presents the fundamentals of nuclear physics and chemistry necessary for technical understanding of radiological problems in public health and covers the major requirements essential for work in this field.

The Robert A. Taft Sanitary Engineering Center is also offering a 2-week training course in plankton analysis, October 24–November 4, designed for personnel in the fields of water supply and limnology. Laboratory practice will be provided in identification and enumeration of algae and other organisms in water supply reservoirs, water treatment plants, and distribution systems. Class discussions and conferences will offer opportunity for consideration of local problems, interpretation of observations, and applicable corrective measures.

Applications or requests for detailed information on any of these courses should be addressed to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a Public Health Service Regional Office director.

U.S. Interest in World Nutrition

ARNOLD E. SCHAEFER, Ph.D., and FRANK B. BERRY, M.D.

The United States has a sincere interest in world nutrition. Food, nutrition, and health are basic needs of people everywhere, but hungry, underfed, malnourished populations can have little concern for anything but their need for food and well-being. They are subject to the ravages of disease, further diminishing their productive capacity. The result is a vicious revolving chain of physical, mental, and economic hardships.

To break this cycle there are those who advocate the "economic aspect" as the real and only solution to the world's problems. Health and well-being cannot be purchased, however, like a piece of machinery. Certainly the developing countries seek a vigorous economy. But economic vigor will come and be more lasting if it emanates from their own resources and productive capacity.

Education in the broad sense is fundamental to every stage of the search for technical, social, and economic development, which contributes to the improvement of life, liberty, and happiness for all people. Education by "seeing and doing," the so-called extension work or person-to-person approach, brings improvement and lasting benefits through its practical application in agriculture, health, transportation, and industry. And development programs must be thought of in terms of decades, not years; not as temporary aid, but rather as long-term investments.

As we review the world's nutrition and health problems, it becomes clearly evident that the more fortunate countries must be willing to share their technical abilities to assist the less fortunate. It is most encouraging to note the wording of the 1958 amendment to the act authorizing U.S. participation in the World Health Organization, which states, "The Congress of the United States, recognizing that the diseases of mankind, because of their widespread prevalence, debilitating effects and heavy toll in human life, constitute a major deterrent to the efforts of many peoples to develop their economic resources and productive capacities and to improve their living conditions . . . ." As the late Gen. George C. Marshall so aptly stated, the policy of the United States citizenry and Government is and must be directed against hunger, poverty, desperation, and chaos.

For more than a half century the United States has been engaged in combating world health problems, a notable example being the war against yellow fever by the Medical Corps of the Army. Since then there has been a tremendous expansion in research and aid in world health and nutrition by missionary groups, philanthropic organizations, and U.S. support of the United Nations agencies, Food and Agriculture Organization, World Health Organiza-

Dr. Schaefer is executive director of the Interdepartmental Committee on Nutrition for National Defense, National Institute of Arthritis and Metabolic Diseases, Public Health Service. Dr. Berry, chairman of the committee, is Assistant Secretary of Defense (Health and Medical), Department of Defense.

With the Help of Many

The degree of success achieved in demonstrating the interest of the United States in improved standards of nutrition throughout the world must be credited to the many individuals who arranged, assisted, and participated in the program of the Interdepartmental Committee on Nutrition for National Defense.

Special thanks are due Wilfred J. McNeil, former Assistant Secretary of Defense (Comptroller) and former Ambassador William C. Bullitt for their initial support.

The Office of International Security Affairs of the Department of Defense, by adding nutrition to the U.S. military assistance program and placing it in the perspective of a people-to-people approach, gave the words "for national defense" broader meaning—not only military defense of the host country but defense of its life, liberty, and well-being as well.

Nor would this program have been possible without the continuing support and cooperation of the National Institute of Arthritis and Metabolic Diseases, Public Health Service. The vision and planning of the late Dr. Harold R. Sandstead, first executive director of the committee, gave it direction.

The assistance of the Department of State and the sympathetic understanding of its late Secretary John Foster Dulles, the present Secretary Christian A. Herter, and Walter M. Rudolph, assistant science adviser and ICNND member, deserve a special acknowledgment. The staff of the International Cooperation Administration participated and aided in the initial survey programs and in followup work.

In each of the host countries, the staff of the U.S. Embassy has given noteworthy and continued assistance.

Finally, acknowledgment is made to the many United Nations agencies, such as the Food and Agriculture Organization, the World Health Organization, and the United Nations Children's Fund, for the assistance and guidance given by the staffs of international headquarters and the field missions.

The ICNND has granted permission for the publication of the papers on survey findings in this issue of *Public Health Reports*, marking the Fifth International Congress on Nutrition to be held in Washington, D.C., September 1–7, 1960.

tion, and United Nations Children's Fund. In addition, U.S. Government agencies, such as the Armed Forces, Public Health Service, and the International Cooperation Administration, assisted in great measure through our university and college staffs, have greatly expanded their activities in world health problems.

Objectives

In early 1955, the Interdepartmental Committee on Nutrition for National Defense (ICNND) was established by a memorandum of agreement by the Departments of State, Defense, Agriculture, Health, Education, and Welfare, and the International Cooperation Administration. The committee was later joined by the Atomic Energy Commission.

The purpose of this committee, as set forth in the memorandum of agreement, is to supply assistance in nutrition problems of technical, military, and economic importance in foreign countries. The committee is advised and guided by a group of consultants from colleges, universities, government, and private agencies, who are recognized throughout the world as specialists in nutrition, medicine, agriculture, food technology, and biochemistry.

To assist, one needs to know the problem. The lack of statistics on and definition of the major food and nutrition problems in the developing countries is strikingly evident from a mere glance at the reports and literature presently available. Thus the first step must be to resolve this lack. What are the problems? What preventive and corrective measures can be taken, based on the country's resources? Is immediate corrective assistance required?

In January 1956, official requests from the Governments of Turkey, Iran, and Pakistan to the U.S. Government for assistance led the committee to launch a medical nutrition appraisal program in these countries. From

the beginning, it was evident that, although most essential, the mere definition of major food and nutrition problems would be of little benefit to the country concerned or to its underfed and malnourished people. Therefore, the program was designed to assist countries in using their own resources to the best advantage. The need to bring these problems to the attention of the country's national governing bodies and to obtain support and necessary action was also recognized.

In general, a survey team is composed of the following specialists: physicians, biochemist (laboratory director), two or more laboratory assistants, food-service and nutrition specialists, dentists, food technologist, and agricultural economist. Personnel of the host country are given training by working side by side with U.S. team members on the nutrition survey in the areas of clinical, biochemical, and food and agricultural assessment. A unique opportunity is afforded to acquire new scientific knowledge essential to a better understanding and solution of nutrition deficiency diseases.

The armed forces of developing countries afforded many advantages of logistical ease when initiating a nutrition improvement program. These advantages were: (*a*) logistical ease in sampling and transportation, (*b*) appraisal of young, physically active men, fresh from and soon to return to civilian life, (*c*) food supply, habits, customs, and the like which are usually identical with the local area in most countries, (*d*) ease of implementing and testing the program for improvement, (*e*) opportunity to initiate food standards and specifications (often nonexistent) on the largest organized group of consumers, and (*f*) carryover of benefits and improvements in nutrition into the civilian population. As shown in table 1, the more recent surveys have also included civilian populations.

Last, but perhaps most important, the committee in a followup phase makes consultant service available to assist further in specifically defined problem areas.

Many disciplines are essential in improving nutrition and health. It is vitally important to recognize, cooperate with, and assist the programs of the host governmental agencies responsible for health, agriculture, development, and education, and the participation of the U.S. missions and UN agencies having responsibilities in these areas as well.

By July 1, 1961, the committee's program will have been extended to 16 countries, including 5 in the Far East, 4 in the Near East, 4 in South America, 2 in Africa, and 1 in Europe, and also

Table 1. Countries cooperating in the ICNND nutrition program

Country	Date of survey	Number of other U.S. missions	Number of individuals examined	
			Total [1]	Civilian
Pakistan	January 1956	4	2,019	----
Iran	January 1956	4	1,730	----
Korea	June 1956	2	1,514	----
Philippines	February 1957	2	4,234	----
Turkey	April 1957	4	8,519	----
Libya	June 1957	3	3,828	1,629
Alaska [2]	February 1958	2	1,518	805
Spain	April 1958	3	10,727	----
Ethiopia	September 1958	3	6,400	6,200
Peru	April 1959	2	8,194	150
Ecuador	July 1959	2	7,155	4,816
Vietnam	October 1959	2	7,428	4,556
Chile	March 1960	2	----	----
Colombia	May 1960	2	----	----
Taiwan	September 1960	2	----	----
Thailand	October 1960	2	----	----
Lebanon	February 1961	3	----	----

[1] Includes armed forces and civilians.
[2] Before becoming a State.

to our new State of Alaska (table 1). The procedures for conducting the surveys have been described in a number of publications (*1–18*).

In retrospect, it is most encouraging that the armed forces nutrition groups in Iran, Turkey, Pakistan, the Philippines, Korea, and Spain have extended their programs to bring assistance to the civilian population.

The success of these survey missions has been due in great part to the high caliber and dedicated spirit of the members of the nutrition teams, including the host country members. Host country team personnel have usually been supplied from not only the armed forces but from the Ministries of Health and Agriculture and from university staffs. The majority of the U.S. team personnel (numbering over 150) have been most generously supplied by 24 colleges and universities throughout the United States, 10 Government agencies, and more than 10 private or State agencies. The experiences of the team members have amply demonstrated that this is not a "one-way street." They have acquired new knowledge and brought back to their universities and laboratories new problems requiring further research. The surveys have engendered a mutual personal good will and understanding, and returning U.S. team members have joined the "double-duty corps," serving as ex officio ambassadors for the countries they visited. As Dr. James A. Shannon, director of the National Institutes of Health, summarized: "The surveys have stimulated and reawakened interest in clinical nutrition."

Major Nutrition Problems

In many parts of the world, one may be misled at first sight by the good physiques of the people, but it is not unusual to find that life expectancy is short and mortality among children extremely high. The weak or malnourished are not seen walking down the roads and streets. Wherever malnutrition exists, it is always the children who suffer most.

In comparing the results in 14 countries recently surveyed by similar procedures (table 2), it becomes clear that although there are many similarities in nutrition problems, each country, and more often areas within the country, must be considered separately and practical recommendations advanced for the specific area. In comparing the generalizations given in table 2, one must keep in mind that some of the surveys involved only military populations. As would be expected, the greater number of nutrition problems existed in the vulnerable civilian population, particularly among children and pregnant or lactating women.

Inadequate riboflavin nutriture was the most prevalent general finding in seven countries and a special area or group problem in four. Next in frequency of indicator lesions suggestive of suboptional nutrition was lack of vitamin A (general in three countries, in special areas of seven); vitamin C (general in one, in special areas of nine); and thiamine (general in three, in special areas of six). Endemic goiter was found in eight of the countries; however, it was usually confined to specific areas. Protein malnutrition and caloric deficit, although a serious problem in the Korean military in 1953, has been alleviated. A survey in Haiti (*19*), conducted under the auspices of the Williams-Waterman Fund, revealed protein malnutrition to be one of the major problems. As usual, the groups most seriously afflicted were infants, children, and pregnant and lactating women. Anemia of unspecified origin was noted in special groups in seven countries, also, particularly prevalent in mothers and young children and often associated with parasitic infestation. At the time of the Ethiopian, Libyan, and Haitian surveys, the general caloric intake was appraised as suboptimal.

Although we have discussed malnutrition in only a general way, the seriousness of acute nutritional disease has been brought vividly to the attention of the medical profession. As an example, Dr. Oomen (*20*) has stated, "Xerophthalmia has been the most bitter pill for me to swallow during 18 years of doctor's work in Indonesia. The repeated experience of discovering a child recently blinded in the arms of the mother, having to tell her that I now could do nothing more to save the eyesight, remembering that I could have done so with a few spoonfuls of cod liver oil some days ago, these things still enter my nightmares. . . . More printing space nowadays is devoted to a few cases of hypervitaminosis A, induced by an irresponsible vitamin racket, than to the thousands of small

children who die or go blind every year due to the lack of a handful of vitamin A units. What on earth is nutritional science good for, even in the atomic age, if it is not capable of counteracting one of the foulest consequences of bad nutrition?"

Another personal experience was reported to the authors by former Ambassador William C. Bullitt. A young Chinese boy in Taiwan was suffering from night blindness and early stages of xerophthalmia. His doctor informed him that the disease was so far advanced that blindness was inevitable. This young man was befriended by Ambassador Bullitt, employed in his household, and given vitamin A therapy. He recovered his eyesight, is now a sergeant in the Marines, and qualified recently in rifle marksmanship.

Accomplishments

Iran

An Armed Forces Nutrition Committee and Institute was formally established in Iran following the medical nutrition survey in early 1956. Research is in progress on the stability of vitamins and the nutritional evaluation of local foods before and after processing. A modern food and nutrition laboratory was completed in late 1959. The nutrition team of the Iranian Armed Forces has conducted surveys in numerous areas of the country and at various seasons of the year. These surveys revealed evidence of the vast improvement in nutrition and health which followed implementation of the recommendations of the 1956 appraisal. A significant contribution was the modernization and reopening in the fall of 1956 of the Shahi food canning plant, which now supplies canned meat, fruit, and vegetables to the armed forces and civilians. The first Iranian Armed Forces "field-type" ration has been developed using these products. Technical assistance was given by the U.S. International Cooperation Administration's Operations Mission. In the first year of operation, local farmers received an added cash farm income of more than $250,000. A second food cannery is under construction.

The rations for the armed forces now include fish and an increased variety of local vegetables

Table 2. Prevalence of nutrition problems in 13 countries and Alaska, as revealed by ICNND surveys

Country	Riboflavin	Vitamin A	Vitamin C	Thiamine	Goiter	Anemia	Protein	Caloric deficit
Military								
Pakistan (*5*)			C		B			
Iran (*6*)	A	B	B					
Turkey (*7*)	A	A	B		B			
Korea (*10*):								
1953	A	A	A	B		B	A	A
1956	A	B				B		
Philippines (*11*)	A			A				
Peru (*15*)			B	C		B		
Spain (*17*)	B	B	B	B	B			
Civilian								
Ethiopia (*8*)	C	A	B	B	B		B	A
Haiti (*19*)	A	B			B	B	A	A
Civilian and military								
Libya (*9*)	B	B	A	A	B	B	B	A
Taiwan (*12, 13*)	A	A	B	C		B		
Vietnam (*14*)	A	C		A	B	B		
Ecuador (*16*)	B	C		B	B	B	B	
Alaska (*18*)		C	C	C				

NOTE: Numbers in parentheses are references.

LEGEND: A, general nutrition problem; B, problem in specific areas of the country or in special groups; C, evidence manifested by clinical or biochemical or dietary evidence in special areas or groups.

and fruits. Vegetable oils are being fortified with vitamin A. The director of the nutrition laboratory established a poultry (broiler) raising industry which proved successful and served to stimulate private enterprise. Poultry raised by the armed forces is issued as a special supplement for hospital diets.

Specifications and quality control for purchasing and processing foods have been and are being developed. At the Shahi cannery, veterinary officers of the Imperial Iranian Armed Forces serve as food inspectors regardless of whether the consumers are the armed forces or civilians. At the Seventh Iranian Medical Congress in 1959, devoted to nutrition, the Armed Forces Nutrition Committee presented their research findings and a practical program for nutrition improvement. The committee also endorsed the need for a nutritional appraisal of the civilian population. Arrangements have been completed by the committee to have a clinician and a biochemist receive advanced training in nutrition in the United States.

Iran organized the First Armed Forces Inter-Nation Nutrition Conference, held in Teheran, November 1956, and attended by delegates from Pakistan, Turkey, Iraq, the United Kingdom, and the United States.

Pakistan

An Armed Forces Nutrition Service advisory group of consultants and specialists was established in Pakistan as recommended after the nutrition survey of 1956. Laboratory equipment and supplies were transferred by ICNND and used to equip a newly formed Armed Forces Institute of Nutrition. The advisory group, through the institute, initiates, directs, and advises on nutritional research problems affecting the armed forces and their families.

Local foods have been analyzed, especially for riboflavin and vitamin C, to determine their value in supplementing the diet. Study is underway to develop a guava powder as a possibly excellent and cheap source of vitamin C. Studies of vitamin C cooking losses, and methods of minimizing them, have been carried out. New areas and groups, including two civilian schools, have been surveyed. A special study on the prevalence of iron deficiency in recruits, soldiers, and their families was completed and recommendations made for treatment of the anemia; further investigations on ascorbic acid deficiency were made, and study of the goiter problem in the Muzaffarabad area is underway.

Food processing has expanded rapidly in Pakistan and excellent progress has been made, in cooperation with the Armed Forces Nutrition Institute, in developing a cracker-type field ration.

Pakistan sponsored the Third Armed Forces Inter-Nation Nutrition Conference in October 1959, attended by delegates from Iran, Turkey, Libya, Great Britain, FAO, and the United States.

The Pakistan Armed Forces have established liaison with civilian agencies, and a member of the Armed Forces Council on Medical Research serves with the governing body of the Pakistan Medical Research Council.

Lt. General W. A. Burki, who was Surgeon General of the Armed Forces at the time of the 1956 survey, is now Minister of Health and Labor. He has indicated a desire to extend the nutrition program to the civilian population.

Turkey

The Turkish Armed Forces Nutrition Institute (TANI) was officially established. A new ration law, enacted by the Government of Turkey, was followed by menu and ration issue changes which resulted in a nutritionally improved diet. Numerous nutrition surveys have been carried out in different areas and at various seasons since the initial survey in 1956. A progressive nutrition research and development program is underway, which includes food analysis, food technology, biochemistry, and medicine. Schools for training cooks, bakers, and mess officers have been established. Cooperative studies with the staffs of the universities, FAO, and the U.S. Operations Mission are being conducted in numerous civilian schools and institutions.

A field trial to evaluate the practicability and effectiveness of enriching bread with riboflavin for both civilian and military personnel is in progress. Two members of the TANI staff have received additional training in the United

States, one in nutrition and biochemistry, and the other in quartermaster subsistence techniques.

Turkey, with technical assistance from ICA, established a modern meatpacking plant, the supervisors and technicians receiving their training in the United States.

Turkey was host to the Second Armed Forces Inter-Nation Nutrition Conference in Ankara, April 1958, attended by delegates from Iran, Pakistan, Iraq, the United Kingdom, and the United States. The proceedings were published in both Turkish and English (*21*).

Korea

The first opportunity to evaluate the benefits resulting from a nutrition survey came in 1956 when a resurvey was made of the Korean Armed Forces after an initial survey in 1953 conducted by the office of the Surgeon General of the U.S. Army. This resurvey revealed that there was indeed a measurable improvement in the nutritional status of the troops. Following this finding, a central food service committee was established.

There has been continued improvement in the ration planning and issue system. A list of food substitutes to be used as a guide for ration purchase and distribution has been developed. A food laboratory is actively engaged in the development of emergency field-type rations based on indigenous foods. A local gardening and agricultural program has been instituted, one of the most successful examples in the world of agricultural extension work through the armed forces. The improvement in the ration planning and distribution system has consistently reduced overall costs and at the same time enabled the issue of a better balanced ration. A school for training mess officers and cooks has been added to the regular quartermaster training courses.

The improvements in nutrition and health in Korea have been outstanding, combining the various disciplines of education, agriculture, transportation, economics, sanitation, and health.

Taiwan (the Republic of China)

The initial nutrition survey of the Republic of China, Taiwan, was conducted in the fall of 1954 under the auspices of the Surgeon General of the U.S. Army. The ICNND has been requested by the Government of China to reappraise the nutritional status of the armed forces in Taiwan in order to evaluate the effectiveness of the program they have instituted. This survey is planned for September 1960.

The committee assisted in followup work after the 1954 survey by preparing a report on the need for rice enrichment. Two rice enrichment plants, supplied under the Military Assistance Program, have now been in operation for over 2 years. This program, as assessed by the Chinese, is indeed a successful one. It is envisioned that this will be extended to the civilian population. Dr. John B. Youmans, member of the ICNND, made a trip to Taiwan recently and reported: "The Chinese National Armed Forces have an active nutrition program well underway. It appears to be of good quality and indeed effective."

The armed forces, through their excellent vegetable gardening, have made a remarkable contribution to the overall food production of Taiwan. This program not only assists in supplementing the ration with a variety of vegetables and other foods, but also serves as an agricultural training ground for soldiers who will be returning to civilian life.

The Philippines

A nutrition survey was conducted in the Philippines in 1957. In 1959, the ICNND was requested by the Philippine Government and the U.S. Operations Mission to supply a nutritionist and a food technologist to give further assistance in improving nutrition.

The former Philippines Institute of Nutrition has been reorganized so that it is now the Food and Nutrition Research Center of the National Science Development Board. The director of the Food and Nutrition Research Center is a member of the newly organized Armed Forces Central Food and Nutrition Board. Through this board and in cooperation with the nutrition laboratory, an active program has been organized to implement the recommendations of the 1957 survey report. A training course for officers in food service has been prepared and will be ready for operation by July 1, 1960, with an instructional staff drawn primarily from the

Food and Nutrition Research Center. Improvements are being made in ration planning and food distribution. The board has recommended that the use of enriched rice in the armed forces be mandatory. This procedure itself may contribute greatly to the eventual use of enriched rice by the civilian population of the Philippines.

Spain

A nutrition laboratory for the armed forces has been established in Spain's University of Madrid School of Medicine. The ICNND Manual for Nutrition Surveys was translated into Spanish, increasing its usefulness in Spanish-speaking countries. Nutrition survey techniques and programs have been extended to the civilian population by the armed forces and the Ministry of Health. Recommended changes in the ration distribution system have been made and an active program of education has been established for personnel involved in food and nutrition.

Libya

The U.S. Operations Mission in Libya was hopeful of establishing a nutrition group to work initially in the child and maternal health clinics following the ICNND survey in 1957. This has not yet materialized, and a laboratory established at the time of the survey is currently on a standby basis.

However, progress has been made through the followup program of FAO in improving the feeding of school children. During the past year Dr. M. R. Barakat, FAO nutrition education specialist, established two nutrition education centers for headmasters and school teachers. The courses lasting approximately 1 month, were attended by a total of 62 Libyan teachers. A book on nutrition for Libyan primary school teachers was written and translated into Arabic. FAO is greatly encouraged by the progress made in nutrition education and the improved diet of school children.

Ethiopia

Immediately following the initial nutrition survey in Ethiopia in the fall of 1958, another survey of 6,000 school children was conducted by the counterpart members of the original team. A therapeutic test is still in progress to determine whether the observed eye lesions (Bitot's spots), with vitamin A deficiency the suspected cause, will respond to vitamin A therapy (*22*), and also to determine the effectiveness of vitamin C in counteracting the high incidence of gingival lesions noted in the school children.

The Medical Advisory Council and the Minister of Health approved and established recently a nutrition council composed of technical and administrative personnel of the Government agencies responsible for health, agriculture, and education. A nutrition consultant, acting as secretary to the Nutrition Council, is to be assigned for the purpose of integrating nutrition into the programs of the Public Health School at Gondar, the Agriculture Schools at Jimma and Alemaya, the School of Nursing in Asmara, and the University of Addis Ababa. A nutrition laboratory, equipped by the ICNND, has been established at the Pasteur Institute. Personnel have been assigned and a program outlined to enable appraisal by a small epidemiological team of specific nutrition problems as they occur throughout the country.

One of the U.S. team members, Dr. Lester J. Teply, organized a group of Ethiopian students at the University of Wisconsin to discuss individual student problems and to give thought to ways and means by which students, after being trained in other countries, could return to Ethiopia and contribute to the overall improvement, well-being, and health of their people. This idea was expanded by the students themselves and has culminated in the formation of an Ethiopian Student Association, which includes nearly 50 students attending colleges and universities in the United States and Canada.

Peru

An Armed Forces Institute of Nutrition was promptly established in Peru. The counterpart team members have extended the appraisal of the nutritional status of their armed forces by conducting an excellent survey of over 1,600 troops in Peru. Their nutrition and food control laboratories have been combined by the armed forces in order to pursue an active, encompassing nutrition program.

Ecuador

Although the nutrition survey has been completed only recently in Ecuador, sincere interest has been expressed by Government officials, including the Ministries of Defense, Health, and Agriculture, the U.S. Operations Mission, and the U.S. Military Assistance Group, in joining forces to improve nutrition in the entire population of Ecuador. Laboratory equipment and supplies were transferred by the ICNND to the National Institute of Nutrition of Ecuador. The present World Health Organization/Pan American Sanitary Bureau nutrition adviser to Ecuador was a team member of the ICNND survey.

Vietnam

The Vietnam survey having just been completed, it is too early to evaluate accomplishments. However, the key people who served as counterpart personnel on the nutrition survey have been retained in the newly established nutrition laboratory and are actively engaged in assisting local hospitals in diagnosing malnutrition. The excellent cooperation received from the President of Vietnam, the Minister of Health, the Minister of Defense, and the U.S. Mission team leaves little doubt that nutrition will be improved in Vietnam.

Summary

The Interdepartmental Committee on Nutrition for National Defense (ICNND), established in 1955, is an expression of the interest of the United States in world nutrition. Representatives of the Departments of State, Defense, Agriculture, and Health, Education, and Welfare, the International Cooperation Administration, and the Atomic Energy Commission are members of the committee and participate in its work.

The committee supplies, on request, technical assistance to foreign countries in assessing and improving nutritional health. Consultants from colleges, universities, Government, and private agencies give advice and guidance to the committee in nutrition, medicine, agriculture, food technology, and biochemistry. U.S. nutrition teams composed of specialists in these disciplines work side by side with a counterpart team of specialists from the country surveyed, and suggest methods which will effect improvement using available resources.

The nutrition studies sponsored by the committee are a cooperative, scientific, training, and people-to-people program.

Progressive action has been taken to improve the nutrition of the armed forces and the civilian population in 12 countries following ICNND surveys. By July 1, 1961, the committee's operations will have been extended to 16 countries, including 5 in the Far East, 4 in the Near East, 4 in South America, 2 in Africa, and 1 in Europe, and to Alaska, the 49th State.

REFERENCES

(1) Interdepartmental Committee on Nutrition for National Defense: Manual for nutrition surveys. Washington, D.C., U.S. Government Printing Office, 1957, 160 pp.

(2) Berry, F. B., and Schaefer, A. E.: Nutrition surveys in the Near and Far East. U.S. Armed Forces M. J. 9: 91–106, January 1958.

(3) Schaefer, A. E.: Interdepartmental Committee on Nutrition for National Defense. Nutrition Rev. 16: 193–196, July 1958.

(4) Berry, F. B., and Schaefer, A. E.: Program of the Interdepartmental Committee on Nutrition for National Defense. J.A.M.A. 166: 775–777, February 1958.

(5) French, C. E., et al.: A nutrition survey of the armed forces of Pakistan. J. Nutrition (supp. 2) 68: 1–69, July 1959.

(6) Interdepartmental Committee on Nutrition for National Defense: Iran: Nutrition survey of the armed forces. Bethesda, Md., National Institutes of Health, August 1956.

(7) Interdepartment Committee on Nutrition for National Defense: Turkey: Nutrition survey of the armed forces. Bethesda, Md., National Institutes of Health, April 1958.

(8) Interdepartmental Committee on Nutrition for National Defense: Ethiopia: Nutrition survey. Bethesda, Md., National Institutes of Health, September 1959.

(9) Interdepartmental Committee on Nutrition for National Defense: Libya: Nutrition survey of the armed forces and civilians. Bethesda, Md., National Institutes of Health, December 1957.

(10) Williams, R. R., Combs, G. F., McGanity, W. J., and Kertesz, Z. I.: A nutrition survey of the armed forces of the Republic of Korea. J. Nutrition (supp. 1) 68: 1–80, June 1959.

(11) Darby, W. J., et al.: A nutrition survey of the armed forces of the Philippines. Am. J. Clin. Nutrit. 7: 657–710, November–December 1959.

(12) Pollack, H., et al.: Studies on nutrition in the Far East. Metabolism 5: 203–308, May 1956.

(*13*) Jolliffe, N., and Tung, Ta-Cheng: Nutrition status survey of the civilian population of Formosa. Metabolism 5: 309–327, May 1956.

(*14*) Interdepartmental Committee on Nutrition for National Defense: Vietnam: Nutrition survey. Bethesda, Md., National Institutes of Health. (In press.)

(*15*) Interdepartmental Committee on Nutrition for National Defense: Peru: Nutrition survey of the armed forces. Bethesda, Md., National Institutes of Health, April 1960.

(*16*) Interdepartmental Committee on Nutrition for National Defense: Ecuador: Nutrition survey. Bethesda, Md., National Institutes of Health, June 1960.

(*17*) Interdepartmental Committee on Nutrition for National Defense: Spain: Nutrition survey of the armed forces. Bethesda, Md., National Institutes of Health, November 1958.

(*18*) Interdepartmental Committee on Nutrition for National Defense: Alaska: An appraisal of the health and nutritional status of the Eskimo. Bethesda, Md., National Institutes of Health. (In press.)

(*19*) Sebrell, W. H., et al.: Appraisal of nutrition in Haiti. Am. J. Clin. Nutrit. 7: 538–584, September–October 1959.

(*20*) Oomen, H. A. P. C.: III. Clinical experience on hypovitaminosis A. Fed. Proc. (supp. 2, pt. II) 17: 111–124, September 1958.

(*21*) Bulletin of the Second Armed Forces Inter-Nation Nutrition Committee Conference, Ankara, Turkey, 14–16 April 1958. Surgeon General, Turkish National Defense, 389 pp. (In Turkish and English.)

(*22*) Darby, W. J., et al.: Bitot's spots and vitamin A deficiency. Pub. Health Rep. 75: 738–743, August 1960.

Latest Nutrition Surveys

Teams of specialists completed the 13th ICNND survey in Chile in June and the 14th in Colombia in August 1960. Future surveys are scheduled to begin in Taiwan in September 1960, in Thailand in October 1960, and in Lebanon in February 1961.

The surveys, which lasted for approximately 70 days in the two Latin American nations, were requested by the respective governments to assess the nutritional status of large sections of the civilian and military populations. The teams of clinicians, biochemists, nutritionists, dentists, food technologists, and others from various institutions in the United States worked with counterpart Chilean or Colombian personnel in conducting physical examinations, biochemical studies, and dietary surveys. The purpose of the work was to formulate practical recommendations for improvement of nutrition consistent with the resources of the countries and to assist in developing standard ration requirements and local nutrition services.

After the surveys, laboratory equipment and supplies sent to the countries were turned over to the Governments of Chile and Colombia to be used in operating permanent nutrition services.

Suggested Guide for Interpreting Dietary and Biochemical Data

INTERDEPARTMENTAL COMMITTEE on NUTRITION for NATIONAL DEFENSE

These provisional standards were submitted by the Committee of Consultants to the Interdepartmental Committee on Nutrition for National Defense and were accepted by the committee. The standards were arrived at after long consideration and a pooling of the experience and knowledge of the consultants. This guide merely indicates the extensive evidence upon which the standards are based.

The ICNND consultants subcommittees preparing this report were the nutritional requirements subcommittee: D. Mark Hegsted, Ph.D., chairman, James M. Hundley, M.D., W. H. Sebrell, M.D., Robert E. Shank, M.D., Walter G. Unglaub, M.D., Calvin W. Woodruff, M.D., and Paul L. Pavcek, Ph.D.; and the standard methods for nutrition surveys subcommittee: William J. Darby, M.D., Ph.D., chairman, Wendell H. Griffith, Ph.D., Herbert Pollack, M.D., Ph.D., Gerald F. Combs, Ph.D., William J. McGanity, M.D., Edwin B. Bridgforth, A.B., Irvin C. Plough, M.D., Norman Jolliffe, M.D., William N. Pearson, Ph.D., C. Frank Consolazio, and George V. Mann, Sc.D., M.D.

Three procedures of value in surveys to assess the nutritional status of a population are clinical assessment, biochemical studies of blood and urine, and collection of dietary information. The conduct of surveys presupposes the availability of some standards of reference for interpreting the results obtained. With the initiation by the Interdepartmental Committee on Nutrition for National Defense (ICNND) of a program of nutrition surveys it was essential to define some tentative standards for use in assessing the data in terms indicative of the practical significance of the observations. Although evaluation of the dietary and biochemical data only is considered in this paper, it is evident that all three methods are necessary for a logical overall evaluation of a particular situation. Major disagreements among the three approaches, if consistently found in population groups (as opposed to individuals) and if not explained by recent changes in dietary intakes, must be regarded as a strong indication of error in the assessment.

The Recommended Dietary Allowances of the National Research Council Food and Nutrition Board (*1*) or the somewhat similar standards proposed by other official bodies, such as the Canadian Council on Nutrition (*2*) and the British Medical Association (*3*), often have been employed in the evaluation of dietary surveys in this country as well as in other parts of the world. As indicated by the statement of the Food and Nutrition Board, "The allowances are designed to maintain good nutrition in healthy persons in the United States." They were not designed as standards for assessing survey results. They are not necessarily applicable to situations of stringency or limited food supply. Since the latter conditions are likely to exist in many situations, it is evident

that use of the NRC allowances in assessing nutritional adequacy is unrealistic and impracticable. It is the aim of this paper to present provisional standards for use in interpreting nutrition surveys made by the methods detailed by the ICNND in its Manual for Nutrition Surveys. This purpose is quite different from that of the standards referred to previously.

A major difficulty in attempts to utilize the NRC recommended allowances in the assessment of dietary information is that they are not uniformly related to minimal needs. For example, it would probably be generally agreed that intakes of only 50 percent of the allowances for ascorbic acid, iron, and calcium in adult men have entirely different implications than do similarly low intakes of thiamine, riboflavin, protein, or calories. Thus the commonly used method of reporting the proportion of the population consuming 50, 75, and 100 percent or some other arbitrary division of the allowances does not determine the relative severity of the inadequacies in the diet.

In many situations where resources are limited the most useful service a nutrition survey can make is to point to the critical nutritional areas in which large gains in health and efficiency can be obtained. It is obvious that correction of problems in these areas should be attacked before efforts are made to provide the less urgent benefits which might be obtained from other dietary changes. A cogent example would be the consistent finding in practically any area of the world, including the United States, that, relative to the NRC recommended allowances, calcium is a "principal deficiency." Since this so-called "deficiency" is not demonstrable in measurable terms of health, and no benefit to man of an increased calcium intake has as yet been conclusively demonstrated, it is doubtful whether specific efforts are justified in most regions to meet the supposed deficit. Rather, efforts and expenditures should be directed to more tangible problems.

Undoubtedly many individuals will consider the proposal that intakes which are much below the NRC recommended allowances are "acceptable" as a weakening of the nutritional baseline. We do not believe this to be true. Nutritional research has increasingly emphasized the importance of obesity, atherosclerosis, and other degenerative diseases, and is placing suspicion upon overnutrition of various kinds. It may be noted that many of the less abundantly fed populations are relatively free of those diseases which are a major cause of death in the United States. Optimum nutrition is undoubtedly obtained by an intake of neither too little nor too much of each specific nutrient. Although no attempt has been made in this report to set the upper limits on desirable intakes, this consideration should receive increasing emphasis in the future. The present standards have regarded "adequacy" as above the level at which objective evidence of health improvement does not occur. The standards in this guide are an attempt at an objective evaluation of the data currently available as derived from clinical, experimental, and epidemiological evidence.

The term "high" is used in these standards in the sense of high for the prevention of recognizable clinical deficiencies or definite biochemical evidence of deficiency. Good or satisfactory would be advocated by many to replace this term. Nutrient consumption and biochemical values in the high range will be found in many countries which enjoy a high level of health and productivity. However, the precise health advantages which attend these high levels are the subject of much difference of opinion and little conclusive evidence. There is no implication that intakes in this range are sufficiently high to be detrimental.

The dietary intakes, blood content, or urinary excretion levels designated as "deficient" are those which may be expected to be associated

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Goldberger Award to Vilter

The 1960 Joseph Goldberger Award for outstanding work in nutrition was awarded to Dr. Richard W. Vilter, professor of medicine, Cincinnati College of Medicine. Dr. Vilter led a World Health Organization survey of the causes of anemia and nutritional deficiency diseases in Egypt in 1954, and made a similar study in Guatemala and Panama in 1955 at the request of the Pan American Sanitary Bureau.

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with definite, although not necessarily severe, physical impairment due to insufficiency of a nutrient in a measurable proportion of individuals. It is recognized that there are probably substantial quantitative differences in the nutritional requirements of individuals. These differences, combined with the errors of sampling and of laboratory determination and the substantial differences among physicians in the appraisal of various physical abnormalities, may be expected to prevent a high correlation between the dietary, biochemical, and clinical evaluation of individuals. Repeated study by all three methods should tend to eliminate such discrepancies. If the various standards proposed are realistic, there should be a measure of agreement of the three methods when applied to population groups over reasonable periods of time.

It should be emphasized that these guidelines are proposed for the express purpose of evaluating and interpreting dietaries in relation to nutritive state. Therefore, the purpose is quite different from that of the NRC recommended allowances in some instances.

Dietary Standards

Since the primary interest of the Interdepartmental Committee on Nutrition for National Defense was directed toward the nutritional status of the armed forces in various countries, the dietary standards for the interpretation of nutrient intake data were designed to apply to adult males, physically active, with an average height of 67 inches (170 cm.) and weight of 143 pounds (65 kg.) living in a temperate climate and consuming a varied diet. Wherever evidence is available to justify and allow modification because of age, body size, activity, climate, type of food, and other factors, such modifications should be made.

Table 1. Average percentage of nutrients lost during cooking

Food items	Thiamine	Riboflavin	Niacin	Ascorbic acid
Meats	35	20	25	
Meats plus drippings	25	5	10	
Eggs	25	10	0	
Cereals	10	0	10	
Legumes	20	0	0	
Vegetables—leafy green and yellow	40	25	25	60
Tomatoes	5	5	5	15
Vegetables, other	25	15	25	60
Potatoes	40	25	25	60

Calculations of dietary information collected should make appropriate allowance for nutrient losses during food preparation and storage. Despite recognition that such losses vary depending upon differing preparation and cooking methods in use in different cultures, and that local values should be used whenever they are available and reliable, the values in table 1 were regarded as reasonable approximations in the absence of more specific data. These values have been taken directly from the Army Technical Manual, TM 8–501 (*4*), and represent losses with good cooking practice with U.S. Army ration components.

From the good agreement between calculated values for the raw food and analytic values for the cooked food samples from the army messes in most countries surveyed by ICNND, it would appear that cooking losses are not so great as those indicated in table 1. The calculations in the survey reports assume valid values for the composition of the local foods. However, knowledge of nutrient composition is often fragmentary. Additional studies on the composition of raw and cooked foods would usefully extend knowledge basic to evaluation by dietary studies.

Table 2 presents the suggested standards for the evaluation of nutrient intake. Although within the space allotted it is not possible to document fully the reasons for these suggested values, the basic facts are presented for each nutrient.

Thiamine. The minimum need of thiamine may be considered as reasonably well established since studies on animals and man are in essential agreement. Clear-cut evidence of thiamine deficiency has been obtained at levels below 0.2 mg. per 1,000 calories (*5–7*). Epidemiological evidence suggests a similar figure (*8*). Evidence of unsaturation is available at intakes of about 0.3 mg. per 1,000 calories (*9*). Although there is good evidence of a relationship between thiamine need and caloric expenditure, it is not entirely clear that this is uniform at all levels of caloric intake. It is accepted that

Table 2. Suggested guide to interpretation of nutrient intake data for physically active young adult males

Nutrient	Deficient	Low	Acceptable	High
Niacin (mg./day)	<5	5–9	10–14	≥15
Riboflavin (mg./day)	<. 7	0. 7–1. 1	1. 2–1. 4	≥1. 5
Thiamine (mg./1,000 calories)	<. 2	0. 2–0. 29	0. 3–0. 4	≥. 5
Ascorbic acid (mg./day)	<10	10–29	30–49	≥50
Vitamin A (I.U./day)	<2, 000	2, 000–3, 499	3, 500–4, 999	≥5, 000
Calcium (gm./day)	<. 3	0. 30–0. 39	0. 4–0. 7	≥. 8
Iron (mg./day)	<6. 0	6–8	9–11	≥12
Protein (gm./kg. body weight)	<. 5	0. 5–0. 9	1. 0–1. 4	≥1. 5

fat in the diet spares thiamine, although the data on man do not permit quantitation of the effect. Refinement of the estimate to allow for the thiamine-sparing effect of fat has not been attempted, but its possible importance should not be ignored in the interpretation of data.

Niacin. The requirement for niacin for animals and man is approximately 10 times the thiamine requirement. From the composition of pellagragenic diets Frazier and Friedemann (*10*) estimated 7.5 mg. of niacin per day as a minimum requirement. Pellagra has been produced experimentally on diets very low in tryptophan (200 mg.) which contained about 5 mg. of niacin (*11*). On the other hand, pellagra was not observed with diets supplying similar amounts of niacin when relatively good sources of tryptophan were present (*12*) or in a North Carolina population consuming an average of 5 mg. daily (*13*). Evidence of tissue unsaturation has been found with diets low in tryptophan and containing 8 to 10 mg. of niacin. The kind and amount of dietary protein is thus of importance. Approximately 60 mg. of tryptophan may be considered roughly equivalent to 1 mg. of niacin. The availability of niacin in various foods may also vary (*14*, *15*), and contribute to the well-known epidemiological relationship between corn diets and pellagra.

Riboflavin. Evident signs of riboflavin deficiency have been produced at levels of intake below 0.6 mg. per day, and progressive tissue unsaturation, as measured by urinary excretion, may be noted at levels below 1.1 to 1.3 mg. per day (*16*, *17*). Although on the basis of the known functions of riboflavin one might expect the requirement to be related to caloric expenditure, the evidence is not so convincing as it is with thiamine, and there is some evidence to the contrary. The minimum level of 0.7 mg., listed as "deficient," is somewhat at variance with the data from Formosa (*18*), where there was clinical evidence of deficiency with intakes approximating 0.9 mg. per day and also from some of the data from the ICNND nutrition surveys.

Since there is experimental evidence that the composition of the diet influences the riboflavin requirement in animals and man (*19*, *20*), additional studies under varying environmental conditions are needed. Possibly such factors as exposure to sunlight, availability of riboflavin in foods, and intestinal synthesis may be of importance. It may also be noted that in growing animals the riboflavin requirement appears to be about one and one-half times the thiamine need, a relatively higher level than that indicated here.

Despite these presently recognized uncertainties, it is held that the level adopted is a useful approximation for the interpretation of the practical significance of survey findings.

Ascorbic acid. An intake of 30 mg. per day of ascorbic acid is considered adequate to prevent all evidence of deficiency (*21*, *22*). Whether higher levels are beneficial is controversial (*23*). In view of the lability of ascorbic acid to cooking and storage losses, a somewhat larger allowance above the minimum need than that provided for other nutrients can be justified.

An intake of 10 mg. of ascorbic acid per day will prevent frank scurvy in most adults. The data from six of the first ICNND surveys (*24*) indicate that serum ascorbic acid levels were definitely reduced when the daily dietary intake was in the range of 15 to 23 mg., and they were apparently associated with an increase in gingival pathology.

Vitamin A. A minimum need of 20 International Units of preformed vitamin A or 40 I.U. (24 micrograms) of beta-carotene (one I.U. equals 0.6 micrograms of beta-carotene) per kilogram of body weight per day is indicated. These values yield figures of approximately 1,300 I.U. of vitamin A, or 2,600 I.U. of beta-carotene per man per day. From their studies Hume and Krebs (*25*) estimated that 1,300 I.U. is the approximate requirement of preformed vitamin A in man and that 2,500 I.U. provides a reasonable margin of safety.

Hume and Krebs concluded that 3,000 I.U. is the minimum dose of beta-carotene to meet the vitamin A requirement but considered 7,500 I.U. as a desirable intake because of variability of carotene absorption. It should be noted that, in general, studies on requirements indicate a ratio of activity of vitamin A to carotene of 1 to 4, whereas by usual definition the ratio is 1 to 2. The absorption and utilization of carotene probably falls as its intake is increased. Furthermore, carotene absorption varies from food to food with methods of preparation and is influenced by fat and antioxidant content of the diet and probably other factors. Thus it may be impossible to specify accurately a single value for vitamin A requirements in terms of carotene under various conditions.

The present recommended allowances (*1*) for vitamin A are based on an assumption that the diet will supply approximately one-third of the activity as preformed vitamin A and the remainder as carotene. This is a condition which is not often fulfilled, especially when one is concerned with wide varieties of national and local patterns of diet. Whether further refinements will be useful or can be formulated remains to be seen. We believe that a fairly wide margin between minimal and acceptable levels is justified since, if good sources are available, a high intake is rather easily achieved.

Dietary sources of vitamin A are often seasonal. In view of body storage of this vitamin and the long time required for depletion, an intermittent intake is not necessarily bad, unless intervals of real depletion occur. Intermittent or seasonal intakes may be the most economic method of meeting the needs. On the other hand, this pattern results in a more precarious situation than that of a continuous supply, and, in areas where such seasonal variations exist, definitive studies of vitamin A status are indicated.

Calcium. All data upon which previous calcium allowances are based came from balance studies. It now appears that these are not a reflection of calcium need (*26–28*). In people accustomed to low calcium diets, balance is achieved at levels of intake of 0.3 gm. per day or lower. Since no biochemical test is available to estimate calcium status and the clinical syndrome of calcium deficiency has not been produced experimentally in man, there is no satisfactory means of estimating the minimum need. Epidemiological evidence indicates that people remain in good health and do not demonstrate, insofar as is known, calcium deficiency upon diets containing about 0.3 gm. of calcium per day. No valid means are available for the translation of data from studies upon experimental animals into quantitative human needs. The values for calcium are, therefore, the most tentative of all which have been presented.

Iron. In normal men, the daily iron loss approximates 1 mg. An absorption of approximately 10 percent is ordinarily found, leading to an apparent requirement of 9 to 12 mg. per day (*29*). It should be apparent that such figures may simply be a reflection of the necessary mechanics required to maintain balance in a person consuming about 10 mg. per day. There is evidence that iron is conserved by both decreased excretion and increased absorption as body stores fall. Thus, there appear to be efficient mechanisms for protection against iron deficiency in the normal male, and maintenance of hemoglobin and protection against iron deficiency is found at intakes much below 9 to 12 mg. per day. Due to growth, pregnancy, or periodic iron loss through menstrual bleeding, the situation in children and women may be quite different. There is abundant evidence that iron requirements are increased by infestation with parasites which lead to blood loss. These factors may be important in a military force. Clearly, in male populations evidence of malnutrition due to iron deficiency must come primarily from evidence other than the dietary intake, that is, hematological or biochemical data.

Protein. In normal adults nitrogen balance

is readily achieved with high quality protein at approximately 0.3 gm. per kilogram of body weight per day and with many vegetable diets at 0.5 gm. per kilogram of body weight per day (*30*). It should be noted that, contrary to the situation with calcium, balance figures are more meaningful because of the rapid adjustment which the body makes to changes in the protein intake. Nevertheless, the difficulties of interpreting balance studies in terms of health and need are widely recognized. It is also impressive that syndromes typical of protein deficiency are rare in adults even in areas where protein intakes are low by U.S. standards. This is consistent with the fact that a daily intake of 3,000 calories from a cereal source signifies an intake of some 60 gm. or more of protein. Such an intake approaching 1 gm. per kilogram of body weight per day is rather easily achieved provided the calorie intake is sufficiently high.

Calories. The standards for the evaluation of caloric intakes are the same as those of the Food and Nutrition Board of the National Research Council (*1*), which were adapted from the report of the Food and Agriculture Organization Committee (*31*). They have been thoroughly discussed in those publications. Physical activity and needs for temperature maintenance are major factors determining energy needs but are difficult to evaluate. There is evidence that the standards may overestimate the needs of certain groups. The data of Konishi and co-workers (*32*) indicate that in military troops the change in caloric intake was not proportional to the body weight in kilograms raised to the 0.73 power ($wt.^{0.73}$), the base used for estimating need. It is difficult to assess whether the populations upon which standard data have been based are of ideal weight. Furthermore, it is known that there is an adaptation to restricted caloric intake (*33*) both by lowered metabolism and by decreased ability and desire to work. Adjustments are made for age and environmental temperature. The effect of climate depends not only upon the temperature, but also on the amount of exposure, the clothing worn, housing, and other factors.

Because of the grossness of the estimates of these several factors in determining dietary needs, attempts to evaluate the adequacy of caloric intake in a nutrition survey should rest largely upon physical appearance and physical measurements, rather than on the intake data. Military personnel with restricted feeding habits and relatively standardized workloads and environments offer opportunities for extension of studies of these factors.

Biochemical Standards

Urinary excretion. The collection of urine samples over a 24-hour period is virtually impossible in most field studies, and shorter periods of collection are essential if urinary samples are to be obtained. There are three possible baselines for the evaluation of the data: a timed sample, urinary volume, or urinary creatinine. Although the relation of these three parameters to the excretion of vitamins or their metabolites deserves more complete investigation, in one study (*34*) in which they were compared as baselines for riboflavin excretion, urine volume was found to be the least desirable. Timed collections and creatinine excretion were consistent with each other and essentially of equal value. As would be expected, the percentage variability between samples decreased as the volume of the sample increased.

Thus, the most desirable sample should be one collected over the longest period of time. On the other hand, the accuracy of the estimate was not greatly increased by an 8- or 12-hour collection as compared with a 6-hour collection. There is reason to believe that thiamine and N′-methylnicotinamide excretion also follow this general pattern. Under the practical conditions of the field it is often impossible to obtain accurately timed specimens; hence the use of urinary creatinine as a reference base probably assures the most consistently dependable results.

In the interest of practicability the standards presented here were initially formulated for a 6-hour collection period. Ordinarily, the examinees are requested to void urine at midnight, and the morning sample at 6 a.m. is collected. If a timed sample is not obtained, the morning sample representing a reasonably long collection period will be the most suitable and possibly will be less influenced by variations in nutrient intake at meal times. Timed samples

have generally proved impractical in the field and most of the data collected on surveys by ICNND teams have been interpreted on the basis of creatinine reference. The values presented in table 3 were based upon an expected creatinine excretion of 1.5 gm. per 24 hours for the "standard" man weighing 65 kg. Studies on the use of casual urine specimens in evaluating excretion rates of thiamine, riboflavin, and N′-methylnicotinamide (*34–36*) demonstrate that this method, although not ideal, is useful in nutrition surveys.

N′-methylnicotinamide. The values in the deficiency range of 0.2 mg. per 6 hours or 0.5 mg. per gram of creatinine are based largely upon the work of Goldsmith and co-workers (*11,37*). Such levels were found in subjects receiving approximately 5 mg. of niacin and 200 mg. of tryptophan daily at the time they developed clinical symptoms of pellagra. At slightly higher tryptophan intakes (250 to 300 mg.) similar levels of excretion have been observed in some subjects without the development of clinical symptoms (*12*).

The excretion of niacin metabolites increases rapidly with intakes above 8 to 10 mg. per day (*11*), and excretions in the acceptable range are compatible with intakes of 12 to 16 mg. per day (*38*) on an average hospital diet (*12*).

Some normal individuals apparently fail to excrete appreciable amounts of N′-methylnicotinamide in the postabsorptive state. Large excretions have been noted in prolonged fasting or muscle wasting. The wide deviations observed in subjects given the same diet in the studies referred to previously should be noted. The interplay of tryptophan and niacin metabolism is well known and a multiplicity of end products result. For practical reasons, surveys in the field are usually limited to a measurement of N′-methylnicotinamide. Analysis for a more extensive series of end products might yield more precise information.

Riboflavin. Extensive studies upon the urinary excretion of riboflavin at different levels of intake are available. Excretions of the order of 50 micrograms (mcg.) per day have been associated with clinical symptoms of deficiency (*16*) and the urinary excretion is about 10 percent of the intake up to an intake of approximately 1.1 mg. per day. Excretion then rises rapidly at higher intakes and may amount to approximately 30 percent of the intake. Thus, excretions between 50 mcg. per day (10 to 12 mcg. per 6 hours) and 120 mcg. per day (30 mcg. per 6 hours) apparently represent unsaturation. Such factors as negative nitrogen balance and physical activity may be associated with variations in excretion. Individual variation in excretion is itself relatively great, as is the variation from sample to sample on the same individual. As has been indicated in the discussion of dietary standards, there is need to determine the applicability of these values to dietary and environmental conditions other than those under which they have been obtained (*37, 39*).

A word of warning is germane regarding application of these particular standards to nutrition survey data. These levels of riboflavin excretion were derived from a study in which a specific riboflavin method was employed. They cannot legitimately be applied to the interpre-

Table 3. Suggested guide to interpretation of urinary vitamin excretion data for physically active young adult males

Urinary metabolite	Deficient	Low	Acceptable	High
N′-methylnicotinamide:				
mg./6 hours	<0. 2	0. 2–0. 59	0. 6–1. 5	≥1. 6
mg./gm. creatinine	<. 5	0. 5–1. 59	1. 6–4. 2	≥4. 3
Riboflavin:				
mcg./6 hours	<10	10–29	30–99	≥100
mcg./gm. creatinine	<27	27–79	80–269	≥270
Thiamine:				
mcg./6 hours	<10	10–24	25–49	≥50
mcg./gm. creatinine	<27	27–65	66–129	≥130

NOTE. The urinary values are based on an average creatinine coefficient of 23 and a man weighing 65 kg., who would be expected to excrete 1.5 gm. of creatinine per 24 hours.

tation of data obtained by other less specific methods of analysis. This comment applies generally to attempts to apply any of the "standards" which are here proposed; methodological comparability is essential or erroneous conclusions may be drawn. The standards only apply when the appropriate experimental techniques are used.

Thiamine. Thiamine excretion is apparently related linearly to intake except at very low levels, although the curves obtained in different laboratories have not been comparable. The relation to clinical symptoms is less clear. Excretion may also be characteristic of an individual (*37*). Intakes of 0.2 mg. per 1,000 calories have been associated with excretions of 5 to 20 mcg. or less per day (*40, 41*) and an excretion of 40 mcg. per day with intakes of 0.35 mg. per 1,000 calories (*42*). On the basis of these controlled experiments, the standards for urinary excretion appear somewhat generous relative to the proposed dietary standards for thiamine, but are supported by results from survey data (*43*). Excretions above 100 mcg. per day are not considered to be compatible with deficiency (*44*).

Blood and Serum Analysis

Hemoglobin and hematocrit. According to Wintrobe (*45*), the average hemoglobin value for normal young men should be 16 gm. percent and the corresponding hematocrit should be 47 percent. Values from 14 to 18 gm. percent for hemoglobin and 40 to 54 percent for hematocrit are considered to be within the normal range. Milam and Muench (*46*) found for white adult males in North Carolina average hemoglobin values of 14.25±1.2 gm. percent and 95 percent of the distributions to be between 11.88 and 16.62 gm. per 100 ml. Values for Negroes in the same region were slightly lower. The values in table 4 have been proposed as lower limits based upon these data as obtained from occidental peoples. A correction for the effect of altitude (*47*) is also proposed. Such corrections have been made in hemoglobin data obtained during the ICNND surveys in Ethiopia and in Peru. The occurrence of low hemoglobin levels is not a sufficient criterion for the diagnosis of iron deficiency without further characterization of the anemia. Parasitism must always be considered as a possible factor, and race and altitude may also require consideration.

Women normally have hemoglobin levels 1 to 1.5 gm. lower than men. Children under 14 years also have levels below the levels found in men and these normally vary with age. Pregnant women normally exhibit hemoglobin concentration changes which vary with the different stages of pregnancy. The standards proposed for men do not apply to women and children.

Serum proteins. The values proposed for serum protein levels also represent somewhat arbitrary figures based upon the distribution of serum proteins in normal persons (*48*). In

Table 4. Suggested guide to interpretation of blood data for physically active young adult males

Blood constituent	Deficient	Low	Acceptable	High
Hemoglobin (gm./100 ml.):				
Sea level	<12.0	12.0–13.9	14.0–14.9	≥15.0
5,000 feet (1,500 M.)	<12.3	12.3–14.2	14.3–15.5	≥15.6
12,000 feet (3,700 M.)	<13.3	13.3–15.4	15.5–17.1	≥17.2
14,000 feet (4,500 M.)	<14.4	14.4–16.7	16.8–18.9	≥19.0
Hematocrit (percent):				
Sea level	<36	36–41	42–44	≥45
5,000 feet (1,500 M.)	<38	38–43	44–46	≥47
12,000 feet (3,700 M.)	<42	42–48	49–55	≥56
14,000 feet (4,500 M.)	<46	46–52	53–64	≥65
Total serum protein (gm./100 ml.)	<6.0	6.00–6.39	6.4–6.9	≥7.0
Serum ascorbic acid (mg./100 ml.)	<.10	0.10–0.19	0.20–0.30	≥.40
Serum vitamin A (mcg./100 ml.)	<10	10–19	20–49	≥50
Serum carotene (mcg./100 ml.)	(1)	20–39	40–99	≥100

[1] See discussion of carotene in text under Blood and Serum Analysis.

view of the many factors associated with nutritional edema (*33*) other than the serum protein level, a close correlation with the occurrence of edema cannot be expected. The total serum protein may be normal, but the albumin to globulin ratio may be abnormal because of an elevated globulin (*49,50*). If protein malnutrition is suspected, the measurement of serum albumin is indicated (*51*).

Ascorbic acid. Voluminous data show that the serum ascorbic acid level generally reflects the dietary intake. The absence of measurable ascorbic acid from the serum is compatible with scurvy, but is not diagnostic. Clear-cut evidence of malnutrition or ill health due to lack of ascorbic acid when serum levels are above 0.2 mg. per 100 ml. is lacking (*21–23*). Serum levels of ascorbic acid will stabilize at different intake levels (*52–54*). In view of the wide variations in ascorbic acid content of different samples of the same food and the variable losses in preparation and storage, the serum levels may be considered as more satisfactory evidence of ascorbic acid status than dietary data.

Although one cannot ignore the effect of various kinds of stress such as surgery, trauma, and illness in altering the serum ascorbic acid level, much of this stress effect is due to a concomitant reduction of dietary intake.

Vitamin A. In surveys of presumably well-nourished individuals most serum vitamin A levels are found to fall between 30 and 50 mcg. (100 to 160 I.U.) per 100 ml. with a few values between 20 and 30 mcg. (66 to 100 I.U.) and some above 50 mcg. per 100 ml. of serum (*55*). (One I.U. is equivalent to 0.3 mcg. of vitamin A alcohol, or 0.344 mcg. of vitamin A acetate (*56*).) In controlled studies in which adults were fed a vitamin A-free diet (*25*) the serum levels gradually decreased over many months to approximately 10 to 40 I.U. (3 to 12 mcg.) per 100 ml. It has been stated that evidence of night blindness usually appears when the serum level is between 50 and 66 I.U. (15 and 20 mcg.) per 100 ml. (*55*). However, Hsu (*57*) did not find clinical deficiency signs until the vitamin A serum level reached 6 I.U. per 100 ml. In Indonesia de Hass and co-workers, investigating xerophthalmic infants and children, found serum values of 7.0 to 10.3 I.U. of vitamin A in contrast to values of 12.2 to 26.9 I.U. in similarly aged subjects without xerophthalmia (*58*). Yarbrough and Dann (*59*) studied dark adaptation and blood vitamin A in a nutrition survey in North Carolina and found that although the blood levels ranged from 7 to 101 I.U. per 100 ml., 96.7 percent of their subjects had normal vision. Most workers will probably agree that a level of 50 I.U. (15 mcg.) per 100 ml. represents no serious depletion. It is suggested that a finding of 5 percent or more of the subjects with levels below 33 I.U. (10 mcg.) or 15 percent below 66 I.U. (20 mcg.) per 100 ml. is evidence of vitamin A deficiency in a population.

In view of the considerable storage of this vitamin in the body, the long time required for depletion, and the seasonal distribution of vitamin A food sources which often occurs, little correlation of blood data with dietary studies can be expected in many areas. Considerable reliance must thus be placed upon the biochemical and clinical evidence. More data upon the serum vitamin A levels in areas where vitamin A deficiency is an actual problem are needed.

Carotene. Nutritional status with regard to vitamin A cannot be evaluated from serum carotene levels alone. The level in the serum reflects the recent dietary intake and gives useful information concerning food habits, particularly in areas where the intake of preformed vitamin A is low. The values for serum carotene in well-nourished men fluctuate widely. Gillum and co-workers (*60*) found values which ranged from 25 to 405 mcg. per 100 ml. with a mean value somewhat over 100 mcg. The values proposed are considerably lower than those suggested by Bessey and Lowry (*61*) and Sinclair (*62*), but are similar to those suggested by the data of Williams (*63*) and Clayton (*64*).

Discussion and Conclusion

Most of the data upon which these provisional standards are based have been obtained in the United States and Europe, generally in controlled experiments. The effect of other environmental factors and the possible interrelationships between nutrients are relatively unexplored. It may be expected that data obtained from nutrition surveys in various parts

of the world which are assessed by uniform methods will contribute materially in this area. In other words, the application of these provisional standards to survey data provide a practical appraisal of the validity of the standards themselves. No nutrition standards can be considered as final or fixed at this time, and the quantity and quality of the work upon which they are based is variable. Thus, they are considered as working standards with the expectation that they will be modified as the justification becomes apparent.

REFERENCES

(*1*) National Academy of Sciences-National Research Council Food and Nutrition Board: Recommended dietary allowances, revised. NAS-NRC Pub. No. 589. Washington, D.C., 1958.

(*2*) Canadian Council on Nutrition: A dietary standard for Canada. Canad. Bull. Nutrition 2: 1–34, March 1950.

(*3*) British Medical Association: Report of the committee on nutrition. London, British Medical Association, 1950.

(*4*) U.S. Department of Defense: Nutrition. Army Technical Manual, TM 8–501. September 1949, p. 19.

(*5*) Holt, L. E., Jr.: The thiamine requirement of man. Fed. Proc. 3: 171–178, September 1944.

(*6*) Jansen, B. C. P.: Thiamine requirements of animals and factors influencing them. *In* The vitamins, edited by W. H. Sebrell and R. S. Harris. New York, Academic Press, Inc., 1954, vol. 3, pp. 472–478.

(*7*) Sebrell, W. H.: Thiamine requirements of man and factors influencing them. *In* The vitamins, edited by W. H. Sebrell and R. S. Harris. New York, Academic Press, Inc., 1954, vol. 3, pp. 478–480.

(*8*) Cruickshank, E. K.: Dietary neuropathies. *In* Vitamins and hormones. New York, Academic Press, Inc., 1952, vol. 10, pp. 1–45.

(*9*) Horwitt, M. K., Liebert, E., Kreisler, O., and Wittman, P.: Investigations of human requirements for B-complex vitamins. National Academy of Sciences-National Research Council Bull. No. 116. Washington, D.C., June 1948.

(*10*) Frazier, E. I., and Friedemann, T. E.: Pellagra, a study in human nutrition. The multiple-factor principle of the determination of minimum vitamin requirements. Quart. Bull. Northwestern Univ. M. School 20: 24–48, spring 1946.

(*11*) Goldsmith, G. A., Rosenthal, H. L., Gibbens, J., and Unglaub, W. G.: Studies of niacin requirement in man. II. Requirement on wheat and corn diets low in tryptophan. J. Nutrition 56: 371–386, July 1955.

(*12*) Horwitt, M. K. et al.: Studies with diets deficient in riboflavin and niacin, together with observations on the excretion of nitrogen and niacin metabolites. J. Nutrition, vol. 60, supp. 1, 1956.

(*13*) Dann, W. J.: The human requirement for nicotinic acid. Fed. Proc. 3: 159–161, March 1944.

(*14*) Chaudhuri, D. K., and Kodicek, E.: Purification of a precursor of nicotinic acid from wheat bran. Nature 165: 1022–1023, June 24, 1950.

(*15*) Chitre, R. G., and Desai, D. B.: (*a*) Physiological availability of essential nutrients (nicotinic acid). (*b*) A new method for the estimation of available nicotinic acid from food stuffs. Indian J. Med. Sci. 3: 471, 479 (1949).

(*16*) Horwitt, M. K., Harvey, C. C., Hills, O. W., and Liebert, E.: Correlation of urinary excretion of riboflavin with dietary intake and symptoms of ariboflavinosis. J. Nutrition 41: 247–264, June 1950.

(*17*) Parsons, H. T.: Further studies on human requirements for riboflavin. Fed. Proc. 3: 162–171, September 1944.

(*18*) Pollack, H.: Studies on nutrition in the Far East. III. Clinical indicator signs of nutritional insufficiencies before and after enrichment of rice with synthetic vitamins. Metabolism 5: 231–244, May 1956.

(*19*) Mannering, G. J., Lipton, M. A., and Elvehjem, C. A.: Relation of dietary fat to riboflavin requirement of growing rats. Proc. Soc. Exper. Biol. & Med. 46: 100–104, January 1941.

(*20*) Widdowson, E. M., and McCance, R. A.: Studies on the nutritive value of bread and on the effect of variations in the extraction rate of flour on the growth of undernourished children. Medical Research Council, Great Britain, Special Report Series No. 287. London, 1954.

(*21*) Peters, R. A., et al.: Vitamin C requirement of human adults. Experimental study of vitamin C deprivation in man. Lancet 1: 853–858, June 5, 1948.

(*22*) Bartley, W., Krebs, H. A., and O'Brien, J. R. P.: Vitamin C requirement of human adults. A report by the Vitamin C Subcommittee of the Accessory Food Factors Committee. Medical Research Council, Great Britain, Special Report Series No. 280. London, 1953.

(*23*) Meikeljohn, A. P.: The physiology and biochemistry of ascorbic acid. *In* Vitamins and hormones. New York, Academic Press, Inc., 1953, vol. 11, pp. 61–96.

(*24*) Berry, F. B., and Schaefer, A.: Nutrition surveys in the Near and Far East. Report of the Interdepartmental Committee on Nutrition for National Defense. Am. J. Clin. Nutrit. 6: 342–353, July–August 1958.

(*25*) Hume, E. M., and Krebs, H. A.: Vitamin A requirement of human adults. An experimental study of vitamin A deprivation in man. Medical Research Council, Great Britain, Special Report Series No. 264. London, 1949.

(26) Hegsted, D. M.: Calcium requirements. Nutrition Rev. 15: 257–258, September 1957.

(27) Leitch, I., and Aitken, F. C.: The estimation of calcium requirement: a reexamination. Nutrition Abstr. & Rev. 29: 393–411, April 1959.

(28) Duncan, D. L.: The interpretation of studies of calcium and phosphorus balance in ruminants. Nutrition Abstr. & Rev. 28: 695–715, July 1958.

(29) Moore, C. V.: The importance of nutritional factors in the pathogenesis of iron-deficiency anemia. Am. J. Clin. Nutrit. 3: 3–10, January–February 1955.

(30) Food and Agriculture Organization: Protein requirements. FAO Nutritional Studies, No. 16. Rome, 1957.

(31) Food and Agriculture Organization: Calorie requirements. Report of the Second Committee on Calorie Requirements. FAO Nutritional Studies, No. 15. Rome, 1957.

(32) Konishi, F. et al.: The dietary composition and adequacy of the food consumed by young men on an ad libitum regimen. J. Nutrition 63: 41–56, September 1957.

(33) Keys, A. et al.: The biology of human starvation. Minneapolis, University of Minnesota Press, 1950.

(34) Hegsted, D. M., Gershoff, S. N., Trulson, M. F., and Jolly, D. H.: Variation in riboflavin excretion. J. Nutrition 60: 581–597, December 1956.

(35) Plough, I. C., and Consolazio, C. F.: The use of casual urine specimens in the evaluation of the excretion rates of thiamine, riboflavin and N′-methylnicotinamide. J. Nutrition 69: 365–370, December 1959.

(36) Gershoff, S. N., Hegsted, D. M., and Trulson, M. F.: Metabolic studies of mongoloids. Am. J. Clin. Nutrit. 6: 526–530, September–October 1958.

(37) Unglaub, W. G., and Goldsmith, G. A.: Evaluation of vitamin adequacy: Urinary excretion tests. *In* Methods for evaluation of nutritional adequacy and status—A symposium. Advisory Board on Quartermaster Research and Development, Committee on Foods. Washington, D.C., National Academy of Sciences-National Research Council, 1954, pp. 69–79.

(38) Frazier, E. I., Prather, M. E., and Hoene, E.: Nicotinic acid metabolism in humans. I. The urinary excretion of nicotinic acid and its metabolic derivatives on four levels of dietary intake. J. Nutrition 56: 501–516, August 1955.

(39) Lowry, O. H.: Biochemical evidence of nutritional status. Physiol. Rev. 32: 431–448, October 1952.

(40) Mickelsen, O., Caster, W. O., and Keys, A.: A statistical evaluation of the thiamine and pyramin excretions of normal young men on controlled intakes of thiamine. J. Biol. Chem. 168: 415–431, May 1947.

(41) Foltz, E. E., Barborka, C. J., and Ivy, A. C.: The level of vitamin B-complex in the diet at which detectable symptoms of deficiency occur in man. Gastroenterology 2: 323–344, May 1944.

(42) Elsom, K. O., Reinhold, J. G., Nicholson, J. T. L., and Chornock, C.: Studies of the B-vitamins in the human subject. V. The normal requirement for thiamine; some factors influencing its utilization and excretion. Am. J. M. Sc. 203: 569–577, April 1942.

(43) Plough, I. C., and Bridgforth, E. B.: Relations of clinical and dietary findings in nutrition surveys. Pub. Health Rep. 75: 699–706, August 1960.

(44) Aykroyd, W. R., et al.: Medical resurvey of nutrition in Newfoundland, 1948. Canad. M. A. J. 60: 329–352, April 1949.

(45) Wintrobe, M. M.: Clinical hematology. Ed. 4. Philadelphia, Lea and Febiger, 1956.

(46) Milam, D. F., and Muench, H.: Hemoglobin levels in specific race, age and sex groups of a normal North Carolina population. J. Lab. & Clin. Med. 31: 878–885, August 1946.

(47) Hurtado, A., Merino, C., and Delgado, E.: Influence of anoxemia on the hemopoietic activity. Arch. Int. Med. 75: 284–323, May 1945.

(48) Milam, D. F.: Plasma protein levels in normal individuals. J. Lab. & Clin. Med. 31: 285–290, March 1946.

(49) Waterlow, J. C., Ed.: Biochemical aspects of protein malnutrition. *In* Protein malnutrition. Proceedings of a conference in Jamaica (1953). Cambridge, England, University Press, 1955, pp. 1–67.

(50) Holmes, E. G., Stanier, M. W., and Thompson, M. D.: The serum protein pattern of Africans in Uganda: Relation to diet and malaria. Tr. Roy. Soc. Trop. Med. & Hyg. 49: 376–384, July 1955.

(51) Youmans, J. B.: Diagnosis of nutritional edema with particular reference to the determination of plasma proteins and consideration of their behavior. *In* Proceedings, round table on nutrition and public health: 16th Annual Conference, Milbank Memorial Fund, March 29–31, 1938, pp. 166–192.

(52) Ralli, E. P., Friedman, G. J., and Sherry, S.: The vitamin C requirement of man. J. Clin. Invest. 18: 705–714, November 1939.

(53) Ralli, E. P., and Sherry, S.: The metabolism of vitamin C. Medicine 20: 251–340, September 1941.

(54) Johnson, R. E., Darling, R. C., Sargent, F., and Robinson, P.: Effects of variations in dietary vitamin C on the physical well being of manual workers. J. Nutrition 29: 155–165, March 1945.

(55) Bessey, O. A.: Blood levels. *In* Methods for evaluation of nutritional adequacy and status—A symposium. Advisory Board on Quartermaster Research and Development, Committee on Foods. Washington, D.C., National Academy of Sciences-National Research Council, 1954, pp. 61–63.

(56) Expert Committee on Biological Standardization, Subcommittee on Fat-Soluble Vitamins: Report. Technical Report Series No. 3. Geneva, World Health Organization, February 1950, pp. 3–7.

(57) Hsu, H. C.: Serum carotinoids and vitamin A in Chinese. Chinese M.J. 61: 238–243, July–September 1943.

(58) de Hass, J. H., Posthuma, J. H., and Meulemans, O.: Xerophthalmia among children in Batavia. Geneesk. tijdsch. v. Nederl.-Indië 80: 928–950, Apr. 9, 1940.

(59) Yarbrough, M. E., and Dann, W. J.: Dark adaptometer and blood vitamin A measurements in a North Carolina nutrition survey. J. Nutrition 22: 597–607, December 1941.

(60) Gillum, H. L., Morgan, A. F., and Sailer, F.: Nutritional status of the aging. V. Vitamin A and carotene. J. Nutrition 55: 655–670, April 1955.

(61) Bessey, O. A., and Lowry, C. H.: Nutritional assay of 1,200 New York State school children. *In* Meals for millions. New York State Joint Legislative Committee on Nutrition, Legislative Document No. 61. 1947, p. 167.

(62) Sinclair, H. M.: The assessment of human nutriture. *In* Vitamins and hormones. New York, Academic Press, Inc., 1948, vol. 6, pp. 101–162 (154).

(63) Williams, H. H., et al.: Nutritional status survey, Groton Township, New York. VI. Chemical findings. J. Am. Dietet. A. 27: 215–221, March 1951.

(64) Clayton, M. M., et al.: Cooperative nutritional status studies in the northeast region. 5. Blood findings. Maine Agricultural Exper. Station Bull. No. 516. Orono, University of Maine, 1953.

NOTE: References to the ICNND Manual for Nutrition Surveys and reports of surveys in each of 12 countries are cited on pages 685–686.

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Relations of Clinical and Dietary Findings in Nutrition Surveys

IRVIN C. PLOUGH, M.D., and EDWIN B. BRIDGFORTH, A.B.

An objective of the nutrition survey program of the Interdepartmental Committee on Nutrition for National Defense (ICNND) is the appraisal of the nutritional status of population groups.

The ICNND survey teams have studied military populations as a whole and have used three general approaches (*1*). Large numbers of individuals were examined clinically, and biochemical studies were performed on a subsample. Food and nutrient intakes were determined both in military messes and in households.

Although the three survey methods, clinical, biochemical, and dietary, require quite different procedures, one would expect them to give the same general results in the evaluation of nutritional status. Interrelations may be limited by the fact that the three approaches measure different temporal aspects of nutriture. The diet survey gives present intake, biochemical studies, that of the recent past, and clinical examination tends to give a history of a longer period in the past. Attempts were made in individual survey reports for the Philippines and Spain to correlate the results of the three approaches, but with little success. One difficulty was that the dietary nutrient intake figures, the incidences of clinical findings, and the means of the biochemical results showed little variation within each survey. It is therefore of interest to combine the data from a number of surveys and look for interrelations within the whole. Such a study should allow an evaluation of the reliability of the data and perhaps also of the survey technique. Integration of all findings might also lead to other results, for example, a better evaluation of human dietary requirements.

Dr. Plough, Lieutenant Colonel, Medical Corps, U.S. Army, is commander of the Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo. Mr. Bridgforth is assistant professor of biostatistics, department of preventive medicine, Vanderbilt University Medical School, Nashville, Tenn.

Methods

The data used in this analysis were taken from reports of nutrition surveys in Iran, Pakistan, Korea, the Philippines, Turkey, Libya, Spain, and Peru, published by the Interdepartmental Committee on Nutrition for National Defense. Several of these reports have also been published in scientific journals, although in somewhat less detail. The material analyzed here comprises results of surveys of military populations only, since military feeding practices permit the application of dietary survey procedures to large homogeneous groups. Thus, the average calculated nutrient intakes in military messes should approximate the in-

takes of individuals more exactly than can be expected in surveys of households.

The mess surveys were done by either the food inventory or recipe method. From the weights of food items consumed per man per day the nutrient intakes were calculated from tables of food composition, with major reliance on the U.S. Department of Agriculture Handbook No. 8 (*2*) and the U.N. Food and Agriculture Organization's tables of food composition (*3*). In many surveys composite food samples were also taken for chemical analysis for nutrient composition. Analyzed values for nutrients were used where possible except for vitamin C. In the latter instance calculated values were used because of the lability of vitamin C in stored samples and because of the frequent presence of interfering substances, particularly in cooked foods.

Large numbers of men were examined for clinical evidence of nutritional deficiency. Systematically selected men from those examined clinically also had blood and urine samples taken for biochemical analysis. Further details of the survey procedure are given in the individual survey reports and the ICNND Manual for Nutrition Surveys.

In the 8 nutrition surveys analyzed, a total of 58 military kitchen surveys were completed in 57 locations. The clinical and biochemical data analyzed were obtained on those subjects examined at these 57 separate locations. The groups included men from the messes surveyed and persons in the same location who ate in other messes. In analyzing the data it was necessary to assume that the nutrient intakes measured in one mess were representative of all mess halls at that location. Food for these messes was generally obtained locally so this assumption seemed reasonable. Thus, 57 sets of more or less complete data were selected which included nutrient intakes and clinical and biochemical findings in regard to these nutrients. The U.S. Army Medical Research and Nutrition Laboratory will publish detailed tabulations of these data, together with graphic correlations between dietary, clinical, and biochemical results.

Examination of the study data revealed reasonable homogeneity within each country. The findings in each nation were therefore averaged to give eight sets of data, parts of which are presented in the table. Unfortunately, only five sets of biochemical data are available because of varying methods of presentation. In taking the averages, the clinical and biochemical findings were weighted for the number of men in each group. Unweighted arithmetic means were taken of the dietary data, because no decision could be made, a priori, whether to weight the averages by the number of men fed in the mess, by the number of men examined in that location, or in some other way.

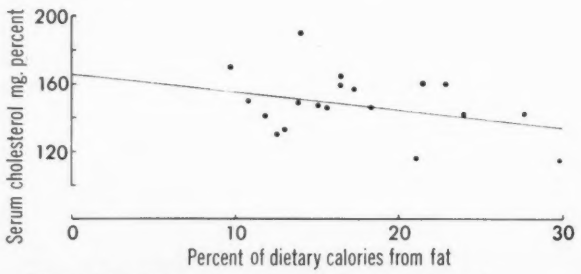
The data presented in the figures include both those from particular locations within countries (filled circles) and the national averages (open circles). Linear regressions were calculated for several sets of data, and in one case a hyperbolic regression was derived after reciprocal transformation of the independent variable. The regressions were calculated from the national figures alone.

Results

The survey results were compared in three general ways: dietary vs. clinical findings, dietary vs. biochemical findings, and clinical vs. biochemical findings. In addition, a few correlations were attempted between selected clinical findings. These various comparisons are described under the headings of individual nutrients.

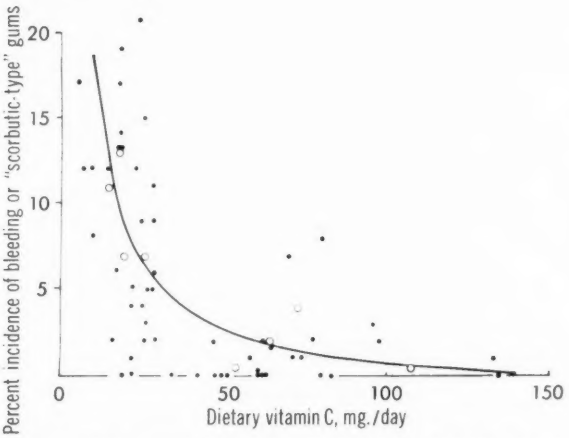
Calories and macronutrients. No correlations were noted between caloric intake and height, weight, percent of "standard weight," or skinfold thickness. There was no interrelation of body weight or percent of "standard weight"

Figure 1. Relation of the serum cholesterol level to the percent of calories in the diet obtained from fat



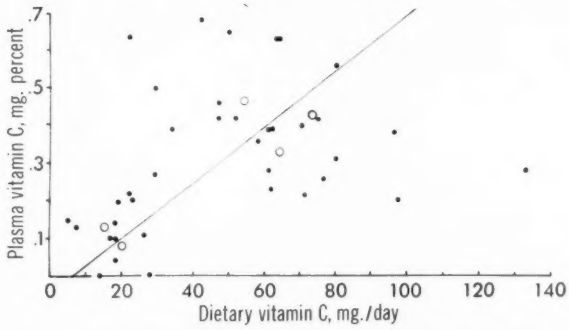
NOTE: The line has the equation, $Y=166-X$.

Figure 2. Relation of the incidence of bleeding or "scorbutic-type" gums to the dietary intake of vitamin C



NOTE: The curve has the equation, $Y=202/X-1.3$.

Figure 3. Relation of the plasma vitamin C level to the dietary intake of vitamin C



NOTE: The line has the equation, $Y=0.007X-0.045$.

with the skinfold thickness. Neither caloric intake nor the parameters of body composition correlated with any of the clinical or biochemical findings. The level of serum protein did not appear to be related to dietary protein intake. A slight negative correlation was observed between dietary fat, expressed as percent of caloric intake, and serum cholesterol level (fig. 1). The equation for the regression line relating these two was $Y=166-X$.

Vitamin C. Clinical findings of bleeding gums or diffusely swollen, dusky, friable gums (recorded as "scorbutic-type") correlated well with the measured dietary intake of vitamin C (fig. 2). The individual mess survey data showed a rather definite cutoff point at about 30 mg. of vitamin C per day, below which an increased incidence of lesions occurred. The mean values for the eight nations showed a more regular progression, described by the equation: $Y=202/X-1.3$.

Dietary vitamin C intakes also correlated reasonably well with the plasma level of the vitamin in the five nations for which data are available (fig. 3). The regression equation relating these two variables was $Y=0.007X-0.045$. The plasma vitamin C level was also negatively correlated with the gingival lesions of swollen, dusky, friable, or "scorbutic-type," gums (fig. 4). Other gingival findings, such as marginal redness and swelling, or recession of the gums, were also slightly correlated with dietary and plasma levels of vitamin C.

Thiamine. Bilateral loss of ankle jerk was not correlated with dietary intake of thiamine (fig. 5), although the urinary excretion of the vitamin was related to the estimated intake of thiamine (fig. 6). The regression equation for the latter two variables was $Y=133X-45$. No correlations were found between other clinical findings, such as calf tenderness or ankle edema, and dietary thiamine, or between these clinical signs and urinary thiamine excretion.

Figure 4. Relation of the plasma vitamin C level to the incidence of bleeding or "scorbutic-type" gums

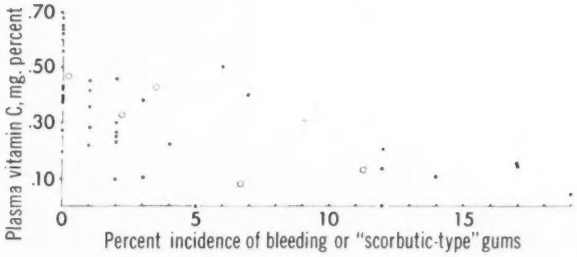


Figure 5. Relation of the incidence of loss of ankle jerk to the dietary intake of thiamine

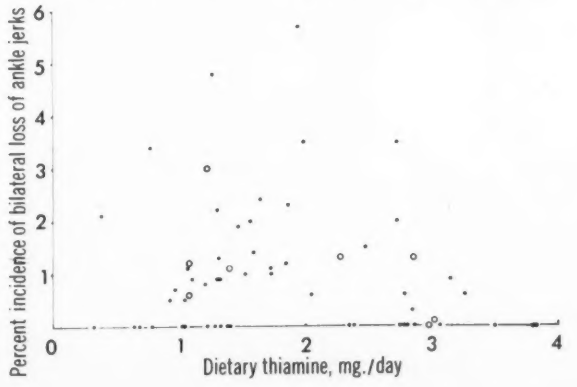
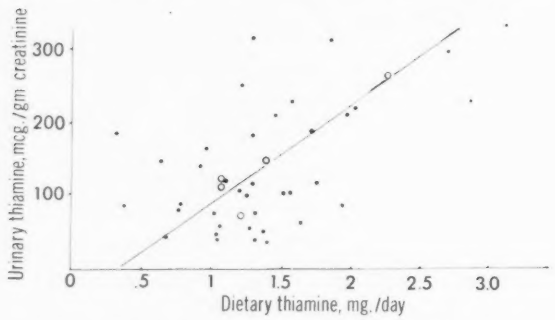
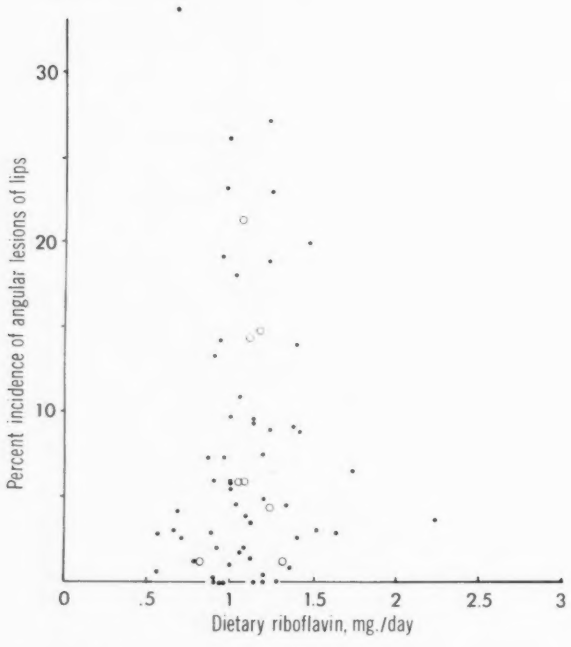


Figure 6. Relation of the urinary excretion rate of thiamine to the dietary intake of thiamine



NOTE: The line has the equation, $Y=133X-45$.

Figure 7. Relation of the incidence of angular lesions of the lips to the dietary intake of riboflavin



Riboflavin. No clinical findings could be correlated with dietary intake of riboflavin. The signs tested included circumcorneal injection, nasolabial seborrhea, angular scars of the lips, angular lesions, cheilosis, filiform papillary atrophy of the tongue, papillary hypertrophy, fissures, red tip or margins of the tongue, magenta tongue, geographic tongue, and scrotal dermatitis. As an example, the incidences of angular lesions of the lips versus dietary riboflavin are presented (fig. 7). A combined scoring procedure was also set up using the four signs, circumcorneal injection, angular lesions, magenta tongue, and scrotal dermatitis. The incidence of each sign was weighted in inverse proportion to its overall incidence in the eight surveys. However, the sum of the weighted incidence rates again did not correlate with the dietary intake of riboflavin.

The urinary riboflavin excretion did tend to be related to the dietary intake of the vitamin (fig. 8), but the red blood cell riboflavin, measured only in the surveys in Spain and Peru, did not.

Niacin. Clear-cut cases of pellagra were not found in any of the eight surveys, and the lesions of thickened, pigmented pressure points and hyperpigmentation of the skin did not correlate with dietary intake of niacin. The

Figure 8. Relation of the urinary excretion rate of riboflavin to the dietary intake of riboflavin

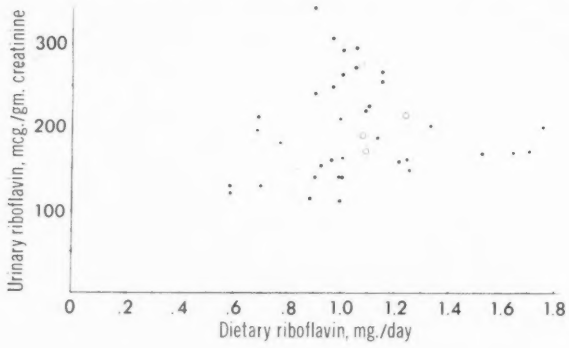
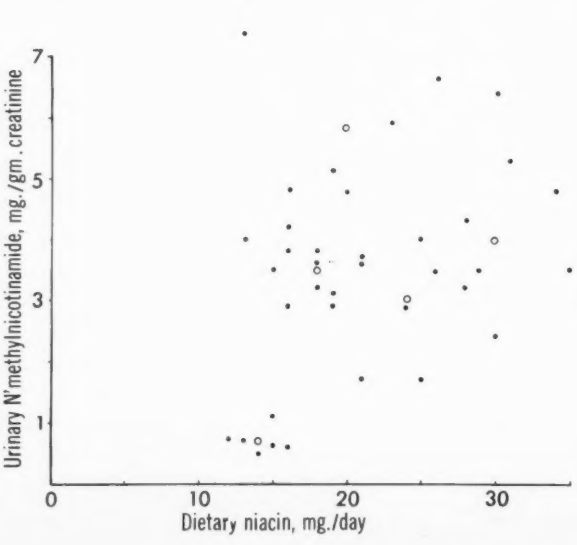


Figure 9. Relation of the urinary excretion rate of N'-methylnicotinamide to the dietary intake of niacin



urinary excretion of N′-methylnicotinamide appeared to be related to the dietary intake of niacin (fig. 9), although most of this correlation was contributed by the low excretion rates of the Libyan survey.

Vitamin A. No correlations were evident between dietary intake of vitamin A and the incidences of follicular hyperkeratosis, either generally or on specific parts of the body, or of Bitot's spots, nor did dietary vitamin A correlate with serum vitamin A or carotene.

Iron. No relations could be discerned between dietary intake of iron and the incidence of the various lesions of the tongue, or between dietary iron and hemoglobin levels, hematocrit, or mean corpuscular hemoglobin concentration.

Discussion

It might be expected that the three general approaches to assessment of nutritional status would give results in individuals or population groups that would compare reasonably well with each other. It should be pointed out, however, that the present assessment procedures have many inherent sources of error. The most obvious errors in clinical examination procedure are the different criteria for diagnosis of a lesion employed by the examiners in the Philippines and Spain although this can be reduced by discussion among examiners and by test exercises in standardization. It is also recognized that a physician's judgment may change unconsciously with time during a given survey. Such examiner differences are likely to be especially great when the population surveyed has lesions of mild degree, as was the case in these nutrition surveys.

As noted previously, the dietary survey results can be misleading as a result of using average figures. Individuals may consume specific nutrients in quantities differing widely from the average consumption. Biochemical data are often claimed to be the most accurate, but these suffer, as do the clinical and dietary results, from errors in sampling, and the average values employed here restrict their usefulness in depicting variations in the nutritional status of the population.

Another basic problem is that the three approaches measure different chronological aspects of nutritional status. The dietary survey notes the average nutrient intakes at the time of the survey. Although the measured intakes may be satisfactory, they may not have been so in the past, and vice versa. The biochemical results reflect the nutrient accumulation by individuals in the relatively recent past. This interval varies for different nutrients. Body stores of vitamin C are relatively small, so that concentrations of ascorbic acid in the blood reflect the intake during the preceding few weeks (*4*). However, large amounts of vitamin A may be stored, and the level of this vitamin may remain satisfactory despite 2 years or more of restricted intake (*5*) of vitamin A and beta-carotene. For development of discreet clinical findings of avitaminosis an even longer period sufficient for exhaustion of particular tissue stores is probably required. Furthermore, once a lesion has been produced, it may require much time to revert to normal, especially on dietary intakes which are only slightly above the body's requirement. Indeed, some lesions or their sequelae may be permanent.

In regard to total food consumption, one would expect correlations between intake and body weight or body size to be masked by the large variations produced in caloric requirement by different levels of activity. Reference of the measured body weight to a standard for height might be expected to uncover a correlation with intake. Unfortunately, the standard weight table widely employed (*6*) depicts for a given height a regular increase in weight with age. This reflects the American population of 1912, from which the table was calculated. There is, however, no valid reason to assume that after the early twenties an individual should gain weight, presumably fat, with each year of age. This problem arising from the use of the standard weight table can cause difficulty in interpretation of survey results, as illustrated by the age-height-weight data from the Philippines (see table). The mean age was 30 years and there was an age-specific mean percent of "standard weight" of 90.8. If the observed height and weight are used and one enters the standard weight table at age 22, the mean age of the other populations surveyed, the percent of "standard weight" is 93.0, more comparable with the other results. Problems of this

Mean clinical, biochemical, and dietary findings in eight nutrition surveys

	Iran	Pakistan	Korea	Philippines	Turkey	Libya	Spain	Peru
Clinical findings								
Number of examinations	1,730	1,568	1,365	433	1,431	538	1,985	1,315
Age (years)			25	30	22	24	22	21
Height (inches)			64.6	63.9	65.6	66.4	64.8	63.5
Weight (pounds)			129.3	121.2	142.2	133.7	135.5	133.7
Percent of "standard weight"	99.3		96.7	90.8	105.5	95.8	102.5	105.9
Skinfold thickness, arm (mm.)			5.5	6.7	7.0		9.9	9.0
Bitot's spots (percent)			.3	.2	.2	.0	.1	.0
Angular lesions of lips (percent)	14.6	.8	14.2	1.3	21.3	5.8	4.7	4.3
Cheilosis (percent)	3.4	.3	1.9	2.0	27.4	.2	11.3	2.4
Atrophy of filiform papillae of tongue (percent)	6.9	.3	1.2	3.1	9.0	.4	1.2	1.6
Glossitis (percent)			.1	.0	.9	.0	.0	.1
Magenta tongue (percent)			1.0	.0	.1	.2	.6	.1
Marginal redness or swelling of gums (percent)	21.9	25.3	21.6	12.9	32.9	45.3	13.8	22.9
Bleeding or "scorbutic-type" gums (percent)	13.0	6.6	.4	.2	11.3	6.7	2.2	3.5
Follicular hyperkeratosis (percent)	31.7	33.4	4.2	2.2	19.4	11.9	23.0	20.5
Scrotal dermatitis (percent)				1.2	1.6	.9	.1	.2
Thickened pressure points (percent)				11.3	.1	.9	.0	.3
Hyperpigmentation (percent)				.2	.3	5.9	.2	.3
Loss of ankle jerk (percent)	1.3	.0	.1	1.2	1.3	3.0	1.1	.6
Calf tenderness (percent)			.1	.1	.8	.4	.3	1.8
Ankle edema (percent)	.6	.0	.1	.1	.2	.0	.0	1.1
Biochemical findings								
Number of determinations	410	409	271	96	277	142	481	260
Hemoglobin (gm. percent)				14.4	15.0	14.7	15.5	14.3
Serum vitamin A (mcg. percent)				46	35	33	37	37
Serum carotene (mcg. percent)				72	59	153	79	71
Serum vitamin C (mg. percent)				.47	.03	.08	.33	.43
Serum cholesterol (mg. percent)				170	191		148	138
Urinary thiamine (mcg./gm. creatinine)				110	265	73	147	126
Urinary riboflavin (mcg./gm. creatinine)				148	172	192	279	217
Urinary N′-methylnicotinamide (mg./gm. creatinine)				5.8	4.0	.7	3.5	3.0
Dietary survey findings [1]								
Number of mess surveys	5	9	4	9	7	6	11	7
Total number of rations	25,000	8,000	17,000	3,100	27,000	3,700	24,000	6,500
Calories	3,860	3,510	3,790	2,740	3,670	3,170	3,290	3,060
Protein (gm.)	137	91	128	100	120	96	109	120
Fat (gm.)	*74	*106	*43	29	*59	*80	74	52
Vitamin A (I.U.)	*3,760	*2,900	*1,220	2,340	2,060	1,660	*1,680	4,360
Thiamine (mg.)	*2.86	*2.98	*3.02	1.09	2.29	1.22	1.40	1.08
Riboflavin (mg.)	*1.18	*1.32	*1.11	.83	1.09	1.08	1.07	1.24
Niacin (mg.)	*34	*26	*21	20	*30	14	18	24
Vitamin C (mg.)	*18	*26	*108	*54	*15	*20	*64	*73
Iron (mg.)	*35	*21	*34	24	50	12	72	67

[1] Composition from chemical analysis except for values marked with an asterisk.

sort explain, in part, the lack of correlation between percent of "standard weight" and the measurements of skinfold thickness, both of which should vary with the amount of body fat, despite genetic and perhaps environmental influences.

The lack of correlation between dietary protein intake and serum protein levels is explained by the fact that no prolonged critically low protein intakes occurred. The negative correlation observed between dietary fat, expressed as percentage of caloric intake, and serum cholesterol is opposite to that reported in many studies. Perhaps this is fortuitous since other factors, such as degree of saturation of dietary fat, were not evaluated, and much of the fat was of vegetable origin.

The best correlations observed here were between dietary vitamin C intake, plasma vitamin C, and clinical findings in the gums. These observations support the known fact that plasma vitamin C rather quickly reflects dietary intake, and suggest that the gingival lesions are relatively labile clinical findings.

Although none of the clinical signs usually related to thiamine deficiency correlated with dietary intake of thiamine, only one finding, the incidence of loss of ankle jerk, was reported in enough individuals to permit a good comparison. This abnormality can occur unrelated to thiamine deficiency, and is known to increase with age. This is also one of the signs that may not readily be reversed.

The lack of correlation between any of the clinical signs and dietary riboflavin intake is unexpected, particularly since riboflavin is not considered to be stored in the body to any appreciable extent. One explanation may be that very few extremely low intakes of the vitamin were found. Another explanation may lie in the nonspecificity of the indicator lesions.

The definite correlation between urinary thiamine excretion rate and thiamine intake indicates that within wide limits, and in large groups, one can be used as a measure of the other. Although the urinary riboflavin and N′-methylnicotinamide excretion rates may be slightly correlated with intakes of riboflavin and niacin, respectively, prediction of one from the other, even with large groups, would be hazardous. The fact that excretion rates of riboflavin were never seen below 100 mcg. per gram of creatinine suggests the presence of nonriboflavin compounds in the urine which interfered with the analysis. Better survey methods for the assay of riboflavin in urine are being developed.

The lack of any correlation between dietary intake of vitamin A and the blood level is doubtless explained by storage of the vitamin in the body during seasons when the intake is relatively high. The fact that there is no relation between the clinical findings and blood levels may reflect either nonspecificity of the lesions or the long time needed for development of the lesions, or the failure to encounter a population sufficiently depleted to have developed clinical signs of avitaminosis.

The average values of clinical, biochemical, and dietary findings for a national survey tend to intercorrelate better than do values for individual groups. Apparently, the limitations of the methods are not so great that they cannot be reduced by an increase in the size of the sample, especially when large national differences in intakes occur.

Data such as these relating dietary intake of a nutrient to the incidence of clinical findings due to deficiency of that nutrient may be used to appraise the human requirement. Indeed, the data for vitamin C do show a marked increase in gingival findings at intakes below 30 mg. per day, the value used in the United Kingdom as the human requirement. For other nutrients, however, the distributions show little that can be used with confidence to estimate the body's requirement.

Another study of nutrition survey results may be made by grouping the data and presenting percentage distributions based on ranges of values considered to be "low" or "high." Tentative ranges of "deficient," "low," "acceptable," and "high" have been set forth in the ICNND Manual for Nutrition Surveys. The biochemical data were tabulated in this manner in all of the survey reports. Comparisons were made between the biochemical data in this form and the clinical and dietary findings. The results were essentially similar to those reported here, using the mean biochemical values. A different type of transformation of the dietary data was also tested, namely, the expression of

nutrient intakes per 1,000 calories. This transformation did not improve any of the correlations with the clinical or biochemical findings.

These results do not invalidate the nutrition survey procedures. They do, however, indicate the relative value of the three different approaches and suggest areas requiring improvement. The detailed and laborious mess survey must remain a standard of reference, although the results are necessarily limited to the period of the survey. The clinical survey is the easiest to perform and, theoretically, should give the measure of nutriture since health, not a specific level of nutrient intake, is the goal of nutritional preventive medicine. As the data show, many errors would be introduced if one relied on the clinical findings alone. The biochemical survey also approaches the evalution of health with more specificity than clinical examination, but as yet even field methods are difficult to carry out; furthermore, they are not available to test many aspects of nutritional status, nor is it possible to observe large numbers of persons with this method.

But nutrition surveys are not designed for the sole purpose of detecting deficiencies. They are intended to provide an appraisal of nutritional level—to give information on food use, nutrients consumed, and sources of nutrients; to indicate whether these observations on diet at a given moment do in fact reflect the usual intake level or pattern; to allow some appraisal of the probable clinical meaning of the cumulative effects of the nutritional level; and to relate these conclusions practically to needs of the country or region toward an improved state of health. When so examined with due consideration of the known physiology of nutrition, findings such as those studied here are exceedingly useful indicators of intake levels, and their meaning for nutritional planning toward better health is increased.

Summary

Data on nutrient intakes were selected from 58 mess surveys in 57 military messes in 8 nations in which nutrition surveys of the military were performed by a standard technique under the auspices of the Interdepartmental Committee on Nutrition for National Defense. These mean data were compared with the clinical and average biochemical findings in troops from the same locations.

The clinical and biochemical findings relating to vitamin C nutriture correlated well with the dietary intakes. The urinary excretion rates of thiamine, riboflavin, and N′-methylnicotinamide correlated roughly with the dietary intakes of thiamine, riboflavin, and niacin, respectively, but the clinical findings widely held to reflect an insufficiency of these vitamins showed scarcely any correlation with dietary intakes. No apparent correlations could be found between the three survey approaches in vitamin A or calorie nutriture. An apparent negative correlation was noted between fat intake and serum cholesterol.

Sources of errors in the interpretation of these findings are identified and discussed. With appropriate recognition of the limitations of each type of evidence and appreciation of nutritional physiology, useful appraisals of nutriture are possible.

REFERENCES

(1) Berry, F. B., and Schaefer, A. E.: Nutrition surveys in the Near and Far East. U.S. Armed Forces Med. J. 9: 91–106, January 1958.

(2) Merrill, A. L., and Watt, B. K.: Composition of foods, raw, processed, prepared. U.S. Dept. of Agriculture Handbook No. 8. Washington, D.C., U.S. Government Printing Office, 1950.

(3) Food and Agriculture Organization: Food composition tables for international use. Rome, March 1954.

(4) Medical Research Council, Great Britain: Vitamin C requirement of human adults. Lancet 1: 853–858, June 1948.

(5) Hume, E. M., and Krebs, H. A., compilers: Vitamin A requirement of human adults. An experimental study of vitamin A deprivation in man. Medical Research Council, Great Britain, Special Report Series No. 264. London, 1949.

(6) Medico-actuarial mortality investigation. Tr. Assn. Life Insur. Med. Directors and the Actuarial Society of America 1: 1–131 (1912).

NOTE: References to the ICNND Manual for Nutrition Surveys and reports of surveys in each of 12 countries are cited on pages 685–686.

Methods Used in Dietary Survey of Civilians in Ecuador

GERALD F. COMBS, Ph.D., and ALVIN C. WOLFE, Ph.D.

Dietary studies constitute an essential part of any complete nutrition survey. Populations which for extensive periods subsist on dietary intakes marginal in protective nutrients may fail to reveal any recognized specific nutritional deficiency lesions, and, at the same time, have a relatively low life expectancy, lowered physical and mental health, increased disease rates, and other manifestations of ill health. Under such conditions, where clinical observations are insensitive for detecting basic nutritional problems, nutrient intake studies are essential.

Reliable information concerning food and nutrient intakes in civilian populations is generally more difficult to obtain during a short period of time than in institutional or military feeding situations. Since small family units rather than large mess units are involved, a much longer survey period is needed to obtain reliable data on a comparable number of people, if the same methods and procedures are employed. The fact that different members of the family (adults, children, infants, and pregnant or lactating women) have different nutrient requirements is still another difficulty.

It has been necessary in such studies, therefore, either to obtain good information on a few individuals or to adopt less accurate procedures which give some information about a large number of people in a short period of time. Very little information exists concerning the relative reliability of these different approaches. Such comparisons were made during the Interdepartmental Committee on Nutrition for National Defense (ICNND) survey of the nutritional status of the armed forces and civilians in Ecuador during the summer of 1959 (*1*). Data on civilians were obtained by a relatively small number of team personnel, using three different dietary survey methods, each based on the family unit and designed to give nutrient intake data. Military messes were surveyed by two methods.

Dr. Combs is professor of poultry nutrition, University of Maryland, and Dr. Wolfe is associated with the General Tire and Rubber Co., Akron, Ohio.

Methodology

Two dietary teams, each consisting of one American nutritionist, two trained Ecuadorian female encuestadoras (interviewers), and one Ecuadorian male interpreter, obtained food intake data for 341 families including 2,087 people by the 24-hour recall questionnaire method and for 28 of these families by the recipe and food composite analysis methods. This was part of a total ICNND survey involving clinical, biochemical, and dietary assessment of their nutritional status. The survey was accomplished during a 7-week period concurrently with or

between dietary surveys conducted in nine military installations. Eight major locations in Ecuador were involved, including 29 specific locations where the 24-hour recall questionnaire method was used and 12 specific locations where the recipe and food composite analysis methods were used.

The design of the study made possible a direct comparison of the three different methods involving the same 28 families (184 people) and a comparison of the results obtained by each of these methods for the 28 families with those obtained by the 24-hour recall questionnaire method for all 341 families.

All three methods used in obtaining food intake data were restricted to 1 day's food supply (three consecutive meals) for the family or household. The nutrient intake was calculated on the basis of the average daily intake for each individual. Information was collected concerning age, sex, and number of lactating or pregnant women, in order to characterize adequately each family unit or group of family units. Heights and weights of individuals also were determined for most of the families surveyed by the recipe and food composite analysis methods.

Each encuestadora was able to collect data for the recipe and the food composite analysis methods in two households for the same three-consecutive-meal period. The selection of families or households to be surveyed by the recipe and food composite analysis methods, as well as the 24-hour recall by questionnaire, was accomplished through the help of local public health officials. In each instance a typical section of a village or part of a city was located, and nearby homes were selected at random just as the three-meal survey was to start. Households containing fewer than four people were not studied. In Guayaquil and in Quito, only areas representative of the lower economic stratum were selected. The location, date, number of families, and number of persons surveyed are given in table 1.

Since the information was collected on a family basis and the families varied markedly as to number of adults, number and age of children, sex, and number of pregnant or lactating women, it was necessary to calculate the allowances for calories and other nutrients by groups of families based on their specific composition and location. The procedure for calculation of the calorie requirement of this mixed population differed from that suggested by the Food and Agriculture Organization (*2*) in that the proportional difference in body size was considered to apply to all age groups over 1 year of age instead of only to those over 16 years of age.

Twenty-four-hour recall questionnaire method. A questionnaire was completed by the Ecuadorian encuestadoras during an interview with the mother or equivalent of each family or household studied. Many of these were completed during interviews with women who had been examined clinically by other members of the survey group. Some were obtained at special clinics for pregnant and lactating women. Others were completed in the homes selected for the more detailed dietary studies.

This questionnaire included a listing of the quantities of specific foods consumed by the entire family or household during the previous day (24-hour recall). In addition, it included a section concerning frequency of use of various food items by the family, and was designed to

Table 1. Location, date, number of families, and number of persons surveyed by three methods in 1-day food intake studies in Ecuador, 1959 [1]

Location	Date	Number of families	Number of persons
Esmeraldas			
Tabiazo	July 31	2	17
Santo Domingo	Aug. 3	4	25
Ibarra			
Andrade Marin	July 30	1	9
Chaltura	July 31	1	11
Ambato			
San Bartolome	Aug. 7	2	15
Riobamba			
Guano	Aug. 10	2	17
Loja			
El Valle	Aug. 17	3	18
Cuenca			
Ricaurte	Aug. 12	2	8
Machala	Aug. 15	2	12
Guayaquil			
Jose Salcedo Delgado	Aug. 25	3	17
Santa Ana	Aug. 26	2	13
Quito	Sept. 2	4	22
Total		28	184

[1] Three methods used were recipe, food composite analysis, and 24-hour recall questionnaire.

Skin-thickness reading at Juan Montalvo School, Portoviejo, Ecuador, during nutrition survey

obtain specific information concerning family income, beliefs concerning foods, and practices of feeding babies and young children.

The food intake data, by families, were summarized by areas according to geographic location. Three of these were on the coast and five in the Sierra region of Ecuador, each summary contributing a minimum of 25-family survey questionnaires. The average amounts of each food item consumed per person per day were used to calculate the average intake of various nutrients per person per day, using tables of nutrient composition prepared by the National Institute of Nutrition of Ecuador (*3*). U.S. Department of Agriculture Handbook No. 8 (*4*) was used for data pertaining to foods not included in the local tables.

Recipe method. For this method the encuestadoras obtained the weights of the edible portion of each food consumed separately or used in the preparation of a particular recipe or dish. These were obtained after preparation waste, if any, was discarded but before the food was cooked. The weights of the prepared foods were also determined after cooking, if the food was cooked. Although seldom encountered, any leftover foods not consumed also were weighed. From these data the average daily food and nutrient intake was calculated using the food composition tables mentioned above (*3,4*).

Food composite analysis method. Each prepared food item was weighed after cooking, if the food was cooked. Any food remaining after the meal also was weighed. From the weight of each prepared food consumed by each family, the average amount consumed per person was obtained. Samples of each prepared food, equivalent to approximately one-fifth to one-half of the amount consumed per person, were obtained at mealtime. From these samples, two food composites were prepared in which each food item was represented on the basis of the average amount actually consumed by each member of the household. One food composite sample was preserved with oxalic acid and the other with alcoholic potassium hydroxide.

Each food item was homogenized in a Waring

Dietary Questionnaire

CARD NO._____ DATE_____
FAMILY NAME_____
TOWN_____ PROVINCE_____
ETHNIC GROUP_____ RELIGION_____
FATHER'S OCCUPATION_____
NUMBER IN HOUSEHOLD:
Total_____ Adults_____ Children_____
Number males over 16 years_____ Ages_____
Number pregnant women_____ Ages_____
Number lactating women_____ Ages_____
Number other women (over 16 years)_____ Ages_____
Number children (under 16 years):
Babies under 1 year_____
Breast fed. Yes_____ No_____
Number other boys_____ Ages_____
Number other girls_____ Ages_____

QUESTIONS

1. What is the total cash income for the family per week?
2. How much is spent on food per week?
3. How many times per week do you buy food?
4. What are the main foods you buy?

Food item	*Amount purchased per week*	*Value*

5. Do you prepare your food on an open fire____ or stove____?
6. How long does it take to cook a meal? ____hours
7. Do you breast feed your babies? ____Yes ____No
8. If there is no mother's milk, what is the young baby fed?
9. At what age are your babies weaned? ____months
10. At what age are other foods given to the baby? ____months
11. What foods would a breast-fed baby receive at
    6 months of age?
    12 months of age?
12. What foods help produce more milk during nursing?
13. What foods should not be eaten during lactation?
14. What foods should be eaten during pregnancy?
15. What foods should not be eaten during pregnancy?
16. What foods, if any, are best during menstruation?
17. Do you give your children any special food? Yes____ No____ If yes, what kinds?
18. Are any of your children in school at any time during the year? Yes____ No____
    If yes, do they receive milk at school? Yes____ No____
    Any other foods?
19. At what age (year) do your children begin to drink coffee____ cocoa____ chocolate____ beer____ other____

20. What foods did your family eat yesterday? (Day of week_____)

Meals	Menu items	Food items, kinds	Amounts, if known	P, H, F [1]	Comments
Breakfast					
Lunch					
Supper					
At other times					

[1] P=Purchased. H=Home-grown or gathered. F=Free gifts or supplements.

	Breakfast	*Dinner*	*Supper*
Number guests present			
Number family members absent			

blendor. One-tenth of the average amount consumed per person was weighed and combined into each composite sample for three consecutive meals. The three-meal food composites also were blended after the addition of either 5 percent oxalic acid or 50 ml. of alcoholic potassium hydroxide (1 percent KOH in 95 percent ethanol) plus 5 ml. of chloroform for each 200 ml. of food slurry. In some instances, food for two or three families was prepared into one 3-day composite. These composites were then shipped to the laboratory where the samples were held under refrigeration (or frozen) until actual nutrient analyses were performed. For some locations duplicate composites, each containing one-tenth of the average daily ration for one or more households, were submitted to two separate laboratories. One of these was the National Institute of Nutrition in Quito, Ecuador, and the other was the Wisconsin Alumni Research Foundation in Madison.

Results and Discussion

The data necessary to characterize the families involved in the 28 households studied in detail as well as all 341 families surveyed by questionnaire are given in tables 2 and 3. The data obtained by direct questioning of the housewife revealed that the average size of the family was 6.4 persons on the coast and 6.1 persons in the Sierra. The average number of children per family was 3.6 on the coast and 3.1 in the Sierra. The average age of children under 16 years was 6.2 on the coast and 7.5 in the Sierra.

The average amount of money earned weekly per family was found to range from 86 to 212 sucres (approximately $5.15 to $12.70), with an average of 79.3 percent of this spent for food in the coastal area and 75.7 percent in the Sierra. This ranged only from an average of 67.5 to 81.4 percent for the eight different locations. Food was purchased an average of 6 times per week on the coast and 4.4 times per week in the Sierra. According to data from the questionnaire, 65.4 and 94.7 percent of the women with babies under 1 year of age were breast feeding them in the coastal and Sierra areas, respectively. Babies were weaned at an average age of 12.3 months on the coast and 13.7 months in the Sierra. Other foods were given to the baby at an average age of 7.8 months on the coast and 6.9 months in the Sierra. On the coast, 58.9 percent of the children of school age attended school; in the Sierra, 61.7 percent. Of these, only 1.3 percent on the coast and 21 percent in the Sierra region received milk at school.

The average age of men over 16 years in the

Table 2. Characteristics of participants in nutritional studies of Ecuadorian civilians by two survey methods, according to location, 1959

Location	Number of families	Number of persons		Average number of children per family	Percent of women pregnant	Percent of women lactating	Average age (years)		
		Total	Average per family				Children	Men	Women
Questionnaire method [1]									
Coast	111	714	6.4	3.6	8.5	2.7	6.2	32.8	29.1
Guayaquil	67	427	6.4	3.5	10.3	2.1	6.6	33.9	30.1
Esmeraldas	23	163	7.1	4.2	7.9	2.5	5.9	24.0	26.0
Machala-Salinas	21	124	5.9	3.1	3.2	4.8	5.4	31.0	26.4
Sierra	217	1,331	6.1	3.1	2.4	4.5	7.5	36.3	35.2
Cuenca	52	312	6.0	3.1	3.2	4.8	7.0	36.3	35.3
Tulcan	84	476	5.7	2.7	2.0	4.2	7.9	37.5	36.6
Ambato-Riobamba	24	195	8.1	4.1	2.6	4.1	7.8	31.5	32.3
Loja	32	198	6.2	3.3	3.0	5.6	7.3	36.9	33.7
Quito	25	150	6.0	3.3	1.3	4.0	7.6	36.7	34.1
3-meal recipe method [2]									
Coast	9	56	7.0	3.2	9.0	.0	6.3	31.7	27.3
Sierra	19	118	6.2	2.9	5.0	2.0	7.5	36.6	30.7

[1] 341 families.
[2] 28 selected families.

28 families studied by means of 24-hour recall questionaire method, recipe method, and food composite analysis method was 35 years. The corresponding age for women was 30 years. The average height for men and women studied was 62.9 and 60 inches, respectively. Males over 16 years of age averaged 133 pounds, women, 118 pounds. These are somewhat less than the weights of the reference man weighing 65 kilograms and the reference woman weighing 55 kilograms at 25 years, used by the FAO Second Committee on Calorie Requirements (*2*).

The energy requirements for the reference man and woman also assumed a mean annual ambient temperature of 10° C. In estimating the caloric requirements for Ecuadorians according to the method suggested by the FAO committee, average weights of 60 kilograms for men and 50 kilograms for women were used. Mean temperatures of 20° C. for the Sierra and 30° C. for the coast were also used. Table 4 gives the calculated average per capita caloric requirement for the Sierra and coastal areas of Ecuador.

A comparison of the nutrient intake data obtained by the three different methods for the 28 families selected for multiple dietary studies with those obtained by the 24-hour recall questionnaire method for all 341 families surveyed is given in table 5. The first three columns present nutrient intake data for exactly the same families. The data for the recipe method and the food composite analysis method include the same day's food supply. The 24-hour recall

Table 3. Participants in nutritional studies of Ecuadorian civilians, percentage of total population, by age and location, 1959

Age group (years)	Questionnaire method [1]										Three-meal recipe method [2]	
	Coast				Sierra						Coast	Sierra
	Guayaquil	Esmeraldas	Machala-Salinas	Average	Cuenca	Tulcan	Ambato-Riobamba	Loja	Quito	Average		
Children												
All ages	54.3	58.3	52.3	54.9	53.2	46.8	50.7	54.6	54.6	51.0	57.0	50.0
0–1	3.7	3.1	4.0	3.6	3.8	4.4	4.1	5.6	3.3	4.3	.0	3.0
1–3	12.2	17.2	16.1	14.0	10.6	6.5	8.7	9.1	8.0	8.3	18.0	11.0
4–6	12.4	16.0	16.1	13.9	10.6	7.8	9.7	11.6	13.3	9.9	14.0	10.0
7–9	11.7	6.7	5.6	9.5	11.9	8.4	7.2	10.6	10.7	9.6	11.0	8.0
10–12	8.0	11.0	7.3	8.5	9.6	10.7	9.7	8.6	10.0	9.9	11.0	8.0
13–15	6.3	4.3	3.2	5.3	6.7	9.0	11.3	9.1	9.3	8.9	4.0	9.0
Men												
All ages	20.6	17.2	22.6	20.2	22.1	26.7	23.1	18.2	19.3	23.0	23.0	20.0
16–19	4.5	2.9	2.5	2.4	3.5	4.8	6.0	3.5	2.7	4.1	1.8	2.8
20–29	7.6	11.5	7.5	6.9	6.0	5.9	6.7	3.1	4.6	5.3	9.7	8.2
30–39	5.2	1.9	8.8	5.7	4.2	4.5	3.7	2.5	5.4	4.1	7.6	2.8
40–49	1.4	1.0	3.8	3.4	3.3	4.8	3.7	5.6	1.4	3.9	1.8	1.0
50–59	1.2	.0	.0	.8	3.3	3.2	1.8	2.0	4.1	3.0	.0	1.8
60 and over	.4	.0	.0	.8	1.5	3.7	1.0	1.5	1.2	2.3	1.8	3.0
Women												
All ages	25.0	24.5	24.9	24.9	24.7	26.6	26.2	27.3	26.0	26.1	20.0	30.0
16–19	2.5	9.8	4.5	5.2	3.7	4.5	4.5	3.3	5.5	4.4	3.6	8.4
20–29	8.5	9.8	13.7	11.0	6.9	6.7	9.4	9.6	4.7	7.0	11.0	9.3
30–39	6.8	.0	6.7	5.7	5.7	4.5	3.7	8.5	4.7	5.0	1.8	4.8
40–49	4.3	4.9	.0	1.5	3.7	4.5	6.3	4.1	7.3	4.7	3.6	3.9
50–59	1.5	.0	.0	1.2	2.7	3.5	1.3	.0	2.6	2.6	.0	1.8
60 and over	1.3	.0	.0	.5	2.0	2.7	1.3	2.2	1.3	2.3	.0	1.8

[1] 341 families.
[2] 28 selected families.

questionnaire method for these 28 families yielded data for the food supply of the previous 24-hour period. The food composite analysis method, of course, involved cooking losses, whereas no cooking losses have been considered in calculating the data by the other two methods.

In general, the agreement is quite good. Considering calories alone, the food composite analysis method yielded 9 percent more and the 24-hour recall method 8 percent less calories per person per day than the recipe method. The relatively very close agreement between the three methods is considered sufficient to validate completely the usefulness of the data collected by means of the 24-hour recall questionnaire procedure.

The fact that both the recipe method and the food composite analysis method yielded slightly higher caloric intakes than the 24-hour recall suggests that the food consumed in the home during the three-meal survey was slightly greater than that which might normally have been consumed. This might be expected in homes surveyed for a 1-day period only. Nevertheless, relatively good agreement in most of the data makes this rather unimportant in interpretation.

The average daily caloric intake as given in table 5 for all 341 families was 1,967 calories per person as compared with 1,639 calories per person, or 17 percent less, for the 28 selected families as measured by the 24-hour recall method. Since the survey method is the same, the data suggest that the 28 families selected for more detailed studies were slightly below the average economic level of the total 341 family sample. This was expected since the 28 families were selected as either typical or below typical families of the general economic level of the community. In the two major cities, Quito and Guayaquil, the selected families were considered typical of a lower economic stratum of the city.

It should be pointed out, perhaps, that, even in the nine military messes in which the survey period averaged 2 days and larger food samples could be taken for the preparation of composite food samples, there was as much or more difference between the nutrient intake data based on the results of the two laboratories performing the analyses as there was between the recipe method and the food composite analysis method. This difference was primarily noted with respect to the values for fat, carbohydrate, calories, and riboflavin. This is emphasized to prevent the assumption that the data derived from the food composite analysis method necessarily are the most nearly correct (*1*).

Table 4. Calculated average daily caloric intake of Ecuadorian civilians in two major areas, by age group and sex, 1959

Age group (years)	Calculated caloric requirements (FAO) [1]			Calculated average per capita daily caloric intake					
				Sierra (20° C.)			Coast (30° C.)		
	Male	Both	Female	Male	Both	Female	Male	Both	Female
0–1		1, 120			1, 120			1, 126	
1–3		1, 300			1, 185			1, 097	
4–6		1, 700			1, 515			1, 435	
7–9		2, 100			1, 871			1, 773	
10–12	2, 500	[2] 2, 450	2, 400		2, 183			2, 068	
13–15	3, 100	[2] 2, 850	2, 600		2, 539			2, 406	
16–19	3, 600		2, 400	3, 226		2, 128	3, 056		2, 016
20–29	3, 200		2, 300	2, 867		2, 039	2, 717		1, 932
30–39	3, 104		2, 231	2, 781		1, 978	2, 635		1, 874
40–49	3, 008		2, 162	2, 695		1, 917	2, 554		1, 816
50–59	2, 768		1, 990	2, 480		1, 764	2, 350		1, 672
60 and over	2, 528		1, 817	2, 265		1, 611	2, 146		1, 526

[1] Based on FAO method of calculating energy requirements as reported in "Calorie Requirements," Rome, 1957.
[2] Average for males and females used, as sex data were not obtained on the 10- to 15-year-old groups.

NOTE: Adult weight: male, 60 kg; female, 50 kg.

In order to test further the reliability of the 24-hour recall questionnaire data, the calculated average daily caloric intake per person for the eight areas, together with the calculated FAO caloric requirements obtained for each of these specific populations, are shown in table 6. The caloric requirements were determined on the basis of the values shown in table 4 for the specific population samples as characterized in tables 2 and 3.

The agreement between the intakes determined by the 24-hour recall questionnaire method and the respective calculated caloric requirements was excellent for all but one location, averaging 99 percent of the requirement calculated for the entire population sample. Comparison of data obtained by the three methods also is made in tables 7 and 8 for the civilian samples in the coastal and Sierra regions of Ecuador, respectively. Since minimum require-

Table 5. Average daily nutrient intake data for Ecuadorian civilians, obtained by three methods, 1959

Nutrient [1]	Recipe method (3 meals)	Food composite analysis method (3 meals)	Questionnaire, 24-hour recall	Questionnaire, 24-hour recall
Calories	1, 776	1, 937	1, 639	1, 967
Protein, total (gm.)	58. 3	66. 6	59. 1	57. 9
Protein, animal (gm.)	23. 2		22. 7	16. 5
Fat (gm.)	33. 5	41. 1	29. 8	38. 1
Carbohydrate (gm.) [2]	322	315	309	376
Calcium (gm.)	0. 40	0. 61	0. 33	0. 38
Phosphorus (gm.)	1. 09		1. 01	1. 09
Iron (mg.)	15. 5	27. 2	19. 7	19. 3
Carotene (mg.)	1. 38	1. 61	1. 92	2. 25
Vitamin A activity (I.U.)	2, 666	3, 068	3, 500	4, 358
Thiamine (mg.)	0. 85	0. 62	0. 81	0. 99
Riboflavin (mg.)	0. 79	1. 25	0. 68	0. 77
Niacin (mg.)	20. 1	17. 9	20. 7	18. 3
Vitamin C (mg.)	79	51	64	107

[1] Cooking losses considered only in food composite analysis method.
[2] Nitrogen-free extract only.

NOTE: Columns 1, 2, and 3 present data on 28 families including 84 persons; column 4 covers 341 families including 2,079 persons.

Table 6. Calculated average daily caloric intake of Ecuadorian civilians in eight areas, obtained by 24-hour recall questionnaire, 1959

Location	Number of persons	Calculated caloric requirements (FAO) [1]	Caloric intake shown by 24-hour recall	Relative percent of calculated requirement
Coast	714	[2] 1, 878	1, 791	95
Guayaquil	427	1, 896	1, 909	101
Esmeraldas-Santo Domingo	163	1, 855	1, 334	72
Machala-Salinas	124	1, 870	1, 990	106
Sierra	1, 331	[2] 2, 057	2, 068	101
Tulcan-Ibarra	476	2, 118	2, 123	100
Quito	150	2, 036	1, 756	86
Ambato-Riobamba	195	2, 110	2, 295	104
Cuenca	312	1, 920	1, 991	104
Loja	198	1, 963	2, 102	107
Total, Ecuador	2, 045	[2] 1, 995	1, 971	99

[1] Based on FAO method of calculating energy requirements as reported in "Calorie Requirements," Rome, 1957.
[2] The families selected for detailed dietary studies yielded a calculated caloric allowance of 1,905 and 2,010 for the 13 families in the coastal area and 15 families in the Sierra, respectively, with an average of 1,976 for the total 28 family samples.

ment data are not available, these tables also show the calculated nutrient allowances based on the National Research Council recommended allowances for each population and considering the percent of each age and sex category. Energy and protein requirements were calculated as described. The actual intakes as determined by the three different methods are expressed as a percentage of these calculated allowances. The agreement among the three methods is considered highly satisfactory. Not only do these methods agree well with each other but the nutrient levels also agree quite well, when considered area by area, with those obtained in a previous dietary study reported by Thomason and associates (*5*).

In Guayaquil, a 7-day survey of 25 families was conducted by the National Institute of Nutrition of Ecuador in June 1959 using the recipe method. The average amount of each of approximately 50 different food items consumed daily per person during this study was ascer-

Table 7. Average daily nutrient intake of Ecuadorian civilians in the coastal area, obtained by three methods, 1959

Nutrient	Calculated standards based on NRC allowances (116 families)	24-hour recall questionnaire (116 families)		3-meal recipe method (13 families)		Food composite analysis method, 3 meals (13 families)	
		Amount	Percent of calculated allowance	Amount	Percent of calculated allowance	Amount	Percent of calculated allowance
Calories [1]	1, 878	1, 791	95	1, 769	94	1, 940	103
Protein (gm.) [2]	53. 3	58. 2	109	57. 2	107	63. 3	119
Calcium (gm.)	1. 04	0. 32	31	0. 32	31	0. 6	58
Iron (mg.)	11. 0	14. 0	127	14. 1	128	21. 0	191
Vitamin A activity (I.U.)	4, 042	4, 554	113	3, 524	87	2, 614	65
Thiamine (mg.)	1. 13	0. 68	60	0. 68	60	0. 39	35
Riboflavin (mg.)	1. 57	0. 69	44	0. 65	42	0. 73	47
Niacin (mg.)	14. 0	11. 5	82	19. 4	139	15. 1	108
Vitamin C (mg.)	62. 0	97. 0	154	86. 0	138	47. 0	76

[1] Based on values shown in table 4.
[2] 86 percent of NRC allowances used, due to weight differences.

Table 8. Average daily nutrient intake of Ecuadorian civilians in the Sierra area, obtained by three methods, 1959

Nutrient	Calculated standards based on NRC allowances (213 families)	24-hour recall questionnaire (213 families)		3-meal recipe method (15 families)		Food composite analysis method, 3-meals (15 families)	
		Amount	Percent of calculated allowance	Amount	Percent of calculated allowance	Amount	Percent of calculated allowance
Calories [1]	2, 057	2, 068	101	1, 783	87	1, 935	94
Protein (gm.) [2]	55. 0	57. 8	105	59. 3	108	69. 2	126
Calcium (gm.)	1. 04	0. 49	47	0. 47	45	0. 61	59
Iron (mg.)	11. 0	22. 3	203	17. 1	155	32. 5	296
Vitamin A activity (I.U.)	4, 287	4, 245	99	1, 453	34	3, 450	80
Thiamine (mg.)	1. 18	1. 17	99	1. 0	85	0. 82	70
Riboflavin (mg.)	1. 64	0. 81	49	0. 91	55	1. 68	102
Niacin (mg.)	16. 0	22. 2	139	20. 8	130	20. 3	127
Vitamin C (mg.)	71. 0	112. 0	158	77. 0	108	54. 0	76

[1] Based on values shown in table 4.
[2] 86 percent of NRC allowances used, due to weight differences.

Table 9. Average daily nutrient intake per person for 25 families in Guayaquil, Ecuador, obtained by two methods in a survey conducted by the National Institute of Nutrition of Ecuador, June 1959

Nutrient	7-day recipe method	Food composite analysis method [1]	
		Laboratory A	Laboratory B
Calories	2,360	2,361	2,299
Protein (gm.)	79.2	74.4	66.5
Fat (gm.)	49.7	66.2	42.8
Carbohydrate (gm.)	398	367	412
Calcium (gm.)	0.50	0.34	0.42
Iron (mg.)	22.0	23.2	16.2
Vitamin A activity (I.U.)	5,143	2,070	----
Thiamine (mg.)	1.17	0.94	0.96
Riboflavin (mg.)	0.92	1.31	0.59
Niacin (mg.)	23.2	21.7	----
Vitamin C (mg.)	95	37	----

[1] Food items obtained in the local market and composited without further preparation. Quantity of foods based on the 7-day recipe method.

Table 10. Intake data on certain nutrients (average per person per day) obtained by the food composite analysis method, Ecuador, 1959

Nutrient	9 military messes	16 Sierra families	12 coast families	25 Guayaquil families
Iodine (mcg.)	190	230	180	100
Lysine (gm.)	3.1	4.1	3.2	4.3
Methionine (gm.)	1.4	1.2	0.8	1.1
Tryptophan (gm.)	0.7	0.6	0.5	0.6
Vitamin B_{12} (mcg.)	2.3	1.6	1.1	2.5
Biotin (mcg.)	63	42	27	46
Folacin (mcg.)	74	77	82	119
Pyridoxine (mg.)	2.0	1.4	1.1	1.3
Pantothenic acid (mg.)	1.1	1.0	0.6	1.5

tained locally, and food composites were prepared for analysis. Table 9 shows the data obtained from the analyses of these composites at two laboratories (identified as A and B), as well as those obtained in the original recipe method study. Again the agreement is quite good. One particular advantage of the food composite analysis method is that it provides a means of obtaining intake data concerning certain nutrients for which satisfactory tabular data are unavailable for most food items. This would include certain highly variable minerals and certain vitamins.

Table 10 includes average daily intake information obtained in the Ecuador survey concerning military and civilian dietaries with regard to the average daily intakes of iodine, lysine, methionine and tryptophan, vitamin B_{12}, biotin, folacin, pyridoxine, and pantothenic acid. Although complete information concerning requirements is not available for some of these, it does not lessen the possibility that certain of them might be marginal.

Summary

Three different methods of collecting dietary intake data among the civilian population of Ecuador have been compared. These are the recipe method, the food composite analysis method, and the 24-hour recall questionnaire method. In general, very good agreement was obtained between the three methods when the same 28 families were studied. The close agreement between the data obtained by these methods made reliable a larger body of data obtained from 341 families by the 24-hour recall questionnaire method alone. The results of this survey indicate that considerable information of a highly reliable nature can be obtained in a relatively short period of time with a minimum of skilled personnel.

REFERENCES

(1) Interdepartmental Committee on Nutrition for National Defense: Ecuador: Nutrition survey. Bethesda, Md., National Institutes of Health, June 1960.

(2) Food and Agriculture Organization: Calorie requirements. Report of the second committee on calorie requirements. FAO Nutritional Studies, No. 15. Rome, 1957.

(3) National Institute of Nutrition: Table of food composition. Quito, Ecuador, revised 1958.

(4) Merrill, A. L., and Watt, B. K.: Composition of foods, raw, processed, prepared. U.S. Dept. of Agriculture Handbook No. 8. Washington, D.C., U.S. Government Printing Office, 1950.

(5) Thomason, M. J., Tobar, R., Olmedo, R., Sanchez, N. M., and Vargas, C.: Dietary studies in Ecuador. Am. J. Clin. Nutrit. 5: 295–304, May–June 1957.

Dental Surveys in Relation to Nutrition

ALBERT L. RUSSELL, D.D.S., M.P.H., NORMAN W. LITTLETON, D.D.S., ERNEST C. LEATHERWOOD, D.M.D., M.P.H., GUNNAR E. SYDOW, D.D.S., M.P.H., and JOHN C. GREENE, D.M.D.

In the past, most dental surveys have been concentrated upon dental caries, and no other phase of study has received more attention than the relation between this disease process and the nutrition or diet of the individual, or of the population group in which he has been found. Nonetheless, no consistent association of dental caries with a deficiency of any known nutrient has been established. The evidence from population studies has been interpreted by at least one reviewer as indicating "no correlation between nutritional status in a group of persons and the prevalence or incidence of dental caries within the group, unless group subsistence stands at, or barely above, the level of starvation." At such low levels of subsistence, caries is usually reported as minimal or absent (*1*).

All of the survey indices commonly employed are cumulative, irreversible measures of lifetime caries experience (*2*); there is no simple, dependable method for determining, in the field, whether caries is presently active or inactive in any individual. The difficulties in relating this lifetime of experience with present (and possibly transient) dietary or nutritional states are obvious. But if nutritional deficiency is cariogenic, it is difficult to explain why the lifetime caries experience is virtually nil among some populations despite a traditional diet grossly inadequate in one or more of the essential nutrients. In one comprehensive review Shaw (*3*) cites studies in which low caries prevalence was found in populations with diets or nutritive states low in vitamin D, in vitamin A, in the "vitamin B-complex," in vitamin K, in calcium, and in phosphorus.

Conversely, a high prevalence or incidence of caries is not invariably associated with diets low in quality. Collins, Jensen, and Becks (*4*) have shown that essential food elements were no more deficient in the diets of 122 college students who were experiencing rampant dental caries than they were in a group virtually free of caries. An inference about the nutritive status of a population, then, based solely on its experience with dental caries, is quite likely to be false.

More information may possibly be gained by a study of oral soft tissues, particularly those which, with bone and associated structures, support the teeth in the dental arch. When these

Dr. Russell is chief, Epidemiology and Biometry Branch, National Institute of Dental Research, Public Health Service, where Dr. Littleton and Dr. Leatherwood are dental surgeons. Dr. Sydow is chief, Ecological Studies Section in the Division of Dental Public Health, and Dr. Greene, assistant to the chief dental officer, Office of the Surgeon General, Public Health Service. Dr. Russell took part in the survey in Alaska, Dr. Littleton participated in the study in Ethiopia, Dr. Sydow, in Peru, Dr. Leatherwood and Dr. Greene, in Ecuador, and Dr. Russell and Dr. Leatherwood, in Vietnam.

periodontal tissues are diseased, the teeth loosen, become painful and ineffective in chewing, and eventually are lost. Local irritating factors, such as calculus and other debris, seem invariably associated with the process. In addition, clinical and laboratory research indicates that something in the physiological state of the individual modifies susceptibility to or progress of the disease (*5*), a hypothesis with some support in field studies (*6*). In the series of surveys reported here emphasis has been given to an effort to discover whether relationships exist between periodontal status in the groups studied and the physical, biochemical, or dietary findings returned by the several field teams of the Interdepartmental Committee on Nutrition for National Defense (ICNND).

Group periodontal status was scored by two methods. One, based on the clinical syndrome of marginal periodontitis, is reversible and responsive to treatment and ephemeral circumstance; it is appropriate for correlation with present nutritive states, as well as indicative of group prevalence of active disease (*7*). The other is a cumulative measure, a count of teeth involved in recession of investing tissues, suggested by Stahl and Morris (*8*). For simultaneous evaluation of local irritating factors, the presence or absence of calculus and of oral debris was noted in the Alaska survey. In Ethiopia the prevalence of calculus was universal and it was necessary to record the relative extent of the deposits. In subsequent surveys, a measure which takes into account the extent of oral debris and stain as well as the extent of calculus (*9*) was employed, modified to include six typical teeth.

All of these examinations were made with mirror and explorer. Patients were seated in a portable dental chair. In Alaska a standard examination lamp was used. In the other areas electricity was not ordinarily available and examinations were made by daylight.

Some striking differences in the prevalence or characteristics of periodontal disease have been seen, concomitant with differences in the nutritional status of the groups studied. Whether these are consistent relationships can be determined only by further analysis and the extension of study to new and appropriate populations.

Brief summaries of the first five ICNND surveys in which dental examiners have participated follow.

Alaska

Dental examinations in the Alaska survey were limited to military personnel. A total of 713 members of the First and Second Scout Battalions, Alaska National Guard, were seen in March 1958. Their ages ranged from 17 to 54 years. They were residents of 55 distinct villages, ranging geographically from Point Barrow, above the Arctic Circle, to Unalaska in the Aleutian chain of islands. The group examined included about one out of each five or six Alaskan Eskimo males in the total adult population. Their general levels of nutrition and physical condition were excellent.

There were extreme variations in dental caries prevalence, associated loosely with place of residence. Men from the principal centers of population averaged 14.5 decayed, missing, and filled (DMF) permanent teeth per person. This is about the same prevalence as has been observed in white males in continental United States at the same average age (about 30 years). Men from selected groupings of villages near the principal centers averaged 13.7 DMF teeth per person. Men in more remote villages averaged 7.1 per person, except those from the Yukon-Kuskokwim delta region, where the mean per man was 2.3. Exposure to fluoride appears not to have been a factor. A decreasing prevalence of caries with increasing isolation is not uncommon in primitive peoples; a similar pattern has been observed in Eskimos of Greenland (*10*), and about the same prevalence of caries was reported for the Kuskokwim area in 1936 (*11*, *12*). In the present study, men from the high-caries villages were slightly but significantly taller than men from the relatively remote low-caries areas. They were somewhat heavier, and their plasma levels of vitamin A and carotene were significantly higher. Other differences, though generally favoring the high-caries villages, were not significant.

Despite the almost universal presence of oral calculus and debris and a relatively high (38 percent) prevalence of the marked crowding of

teeth described and photographed by Price (*13*), men from many of the villages showed little tendency toward the formation of periodontal pockets or loss of alveolar bone. These men were mostly residents of such isolated places as Mekoryuk, on Nunivak Island, or Shungnak, deep in the mountainous area inland from Kotzebue. There was some tendency for their excretion of thiamine and riboflavin to be higher (though plasma vitamin A levels were generally lower) than those of men in the larger settlements. In these larger villages the groups showed about the same patterns of periodontal disease as white males of Baltimore. No relation with plasma vitamin C levels could be demonstrated.

In men aged 35 years or older, alveolar recession followed the same geographic distribution as caries, with men in the isolated villages showing significantly less bone resorption than men in the principal towns.

Ethiopia

Of the five surveyed area groups, the Ethiopians showed the lowest prevalence of dental caries.

Dental caries in 1,085 Ethiopians, 1958

Age group (years)	Number examined	Mean DMF teeth per person	Percent free of caries
5–9	62	0. 13	90
10–14	310	. 18	88
15–19	197	. 21	86
20–29	209	. 39	78
30–39	124	. 69	66
40–49	85	1. 31	57
50 and over	98	2. 86	48

This study, carried out solely with civilian men, women, and children, was conducted during the fall of 1958. A total of 1,085 persons, ranging in age from 5 through 84 years, were examined. The dental sample had representation from each of the major ethnic groups and was obtained from 26 sites in 8 geographic regions of the country.

The prevalence of caries is summarized in the table.

Seventy-seven percent of the people examined were free of dental caries, and individuals under 40 years of age averaged less than one decayed, missing, or filled permanent tooth per person. No individual in the sample was completely edentulous and only seven had received restorative dental care. There was evidence of very mild dental fluorosis in the teeth of persons living in some locations of northern Ethiopia and Eritrea, but fluoride ingestion does not appear to explain the uniformly low occurrence of dental caries (*14*).

The diet of these people was considered to be deficient in total calories, marginal in protein, and high in carbohydrates. The consistency of the diet was soft. The use of refined carbohydrate (sugar) was limited. Mean numbers of DMF teeth appeared to be directly related to the reported frequency of sugar, jam, and honey consumption, as obtained from a questionnaire survey administered by the dietary group.

In contrast to the low prevalence of dental caries in this population, the prevalence and severity of gingival and periodontal diseases were relatively high. The usual clinical finding was one of moderate to severe gingival inflammation with widespread periodontal pocket formation after the age of about 30 years. No differences appeared to be related to ethnic origin or geographic area. Abundant deposits of soft debris and calculus were present about the teeth in virtually all mouths examined. The extent of these deposits was directly related to the condition of the periodontal tissues.

Biochemical determinations were available from about 250 individuals included in the dental sample. Evaluated by ICNND criteria (*15*), 36 percent of the ascorbic acid levels and 5 percent of the vitamin A levels in the serum were low or deficient. Urinary excretion values for thiamine, riboflavin, and N′-methylnicotinamide were all acceptable or high. Within these ranges and as measured by these methods, there was no relation between variations in these values and periodontal lesions.

Peru

The study in Peru was concerned solely with the armed forces. It was conducted during the months of February, March, and April 1959.

During the survey, dental examinations were given to 1,500 men as part of a detailed physical examination in military installations located in seven different geographic areas. The majority (942) of these men were in the age range of 20–24 years, 458 were age 19 years and less, the remainder, age 25 years and older.

Forty-four percent of the men examined had served less than 6 months and 47 percent had from 6 to 24 months of military service. Since these men had lived most of their lives away from the military reservation, the data were tabulated by their previous place of residence as well as by place of examination. Residence areas were grouped as indicated by previous dietary studies (*16–21*).

The preliminary data reveal that, both by place of residence and place of examination, individuals in and from the southern Sierra had the lowest dental caries experience, averaging about one-fourth to one-fifth of what might be expected from a comparable age group in a low-fluoride area in the United States. Of the troops examined in the Puño-Cuzco area of the southern Sierra, 99.8 percent had lived in the same area prior to induction. Most of the troops examined in this area were descendants of the Inca Indians and were accustomed to strenuous activity at high altitudes. The cereal quinoa, an excellent source of natural proteins, was a typical dietary item in this area. The possibility that quinoa may have caries-inhibiting properties is currently under investigation through animal experimentation conducted at the National Institute of Dental Research, Public Health Service.

Periodontal conditions did not vary appreciably by place of residence, and approximated those reported for persons with 8 years of school or less in Birmingham, Ala. (*6*). By place of examination, periodontal scores ranged from a low mean of 0.7 per man at Lima to a high of 1.5 per man at Puño-Cuzco. These periodontal values bear an inverse relationship to the DMF means in these areas.

The wear or attrition of teeth was found to be highest among troops examined in the Puño-Cuzco locations, and may be related to food preparation. In villages of the southern Sierra, meal is frequently ground between a stone slab and a stone roller, thereby incorporating fine abrasive granules into the final food product.

Navy and Air Force enlisted personnel, including a high proportion of skilled technicians of urban origin, scored more favorably on periodontal and oral hygiene status than Army enlisted personnel, a high proportion of whom are relatively unskilled persons of rural origin. Army personnel, however, had considerably lower DMF scores.

Recession of the gums was seen so rarely under the age of 25 years that it was not tabulated, and no cases of what might be considered a functional malocclusion were observed although some crowding of anterior teeth was noted occasionally.

Ecuador

Examinations of 4,975 Ecuadorians ranging in age from 1 to 87 years were carried out during the summer of 1959. Of these, 2,947 were civilians and the remainder, military personnel. Each of the 18 Provinces was represented in this sample.

Dental caries prevalence in the whole population group did not differ greatly from prevalence levels reported for Baltimore, Md. (*22*). The heterogeneity of the Ecuadorian sample is indicated by the variation in dental caries means from different areas of the country. The highest prevalence was recorded for civilians in the northern (Tulcan-Ibarra) and southern (Loja) regions of the Sierra where the average number of decayed, missing, and filled permanent teeth per person was 11.56 at a mean age of 26.8 years. At the other extreme was the strikingly low prevalence of caries found in the Jivaro Indians living in the eastern jungle. The 52 Jivaros examined, averaging 26.5 years of age, had a mean of 1.25 DMF teeth. For the females the mean was 2.18 at an average age of 26.7 years, and for the males the mean was 0.57 at an average age of 26.2 years. No fluoride was found in the water samples collected in the Jivaro territory. The diet of these people is very simple, consisting primarily of yuca (cassava) and platano (cooking banana) with occasional wild game and generous helpings of chicha (a native beverage made of yuca and sweet potato, boiled and fermented).

In the central Sierra region, including the cities of Ambato, Latacunga, and Riobamba, dental caries prevalence was significantly lower than the average for the rest of the country. For persons of all ages from other areas (with a mean age of 21.5 years) the average number of decayed, missing, or filled permanent teeth was 8.6. For persons in the central Sierra region (with a mean age of 24.9 years) the average was 5.2 DMF teeth, a difference of 40 percent. In the 20- to 24-year age group the difference between the two areas is 65 percent. This lowered prevalence of dental caries probably is attributable to differences in the fluoride intake between the two groups. Analyses of water, urine, and food samples show that the people in the central Sierra were ingesting amounts of fluoride which were more than adequate for caries inhibition. In fact, the intake of fluoride was much more than the optimal amount since mottled dental enamel was quite prevalent in this area. In contrast, water samples collected from other areas of the country were consistently low in fluoride.

The area of the country (Loja) having the highest caries prevalence also had the highest consumption of sugar, according to the questionnaire survey done by the dietary group.

Females examined in Ecuador had a higher average number of decayed, missing, and filled permanent teeth than the civilian males of the same ages. The difference was greatest in those over 20 years of age.

Periodontal disease scores for all persons examined were higher than those recorded for equivalent ages in the 1954 Baltimore study. Scores for civilians in the 30- to 39-year age group averaged 1.39, while the average score for the same group in Baltimore was 0.70. There were considerable variations in the periodontal scores by location within the country. Disease was recorded as being most extensive in the northern (Tulcan-Ibarra) and southern (Loja) Sierra regions and least extensive in the eastern jungle (Sucua). This geographic distribution was similar to that seen for dental caries.

Approximately 22 percent of the 30- to 39- and 56 percent of the 60- to 69-year-old dentulous civilians examined in Ecuador showed obvious clinical signs of alveolar bone loss with pocket formation. Of the 30- to 39-year-old males, 68 percent of the military group and 95 percent of the civilians were recorded as having positive signs of gingival inflammation.

Vietnam

The Vietnam survey was carried out in October, November, and December of 1959. As this is being written, analysis of the data is still in the preliminary stage.

Civilians comprised about 65 percent of the sample of 3,700 persons. Dental caries prevalence was low in both civilian and military populations, only slightly higher than that reported for Ethiopians. Periodontal disease was universal in prevalence, and particularly severe and destructive in mountain tribesmen of villages in the central highlands.

Two customs of the people complicated the scoring for dental caries. One, seen in all areas, was the practice of placing gold shell crowns on sound teeth for decorative purposes or as insurance against burial expense. These were ornamented on the facial aspect with cutout designs, most frequently heart shaped, sometimes inlaid with colored plastic or celluloid. An attempt was made, through interpreters, to determine whether these crowns were restorations of carious teeth or purely cosmetic in purpose, and the latter were tabulated separately. On either tabulation, DMF means were minimal. Excluding these gold crowns, the mean number of decayed, missing, and filled permanent teeth for military males of all ages was about two per man. Inclusion of the cosmetic crowns raised the mean per man to about 2.70.

The second custom was observed only in the mountain villages. During puberty rites anterior maxillary teeth had been filed off through the pulp chamber to the level of the gum line; in one area mandibular anterior teeth had been filed to points as well. In this last district the filed stumps were generally carious or, in many instances, had been exfoliated. Elsewhere the filed stumps tended to be free of caries. For the 180 individuals 20 years of age or older in these villages there was an average of 5.3 filed teeth per person. Mean numbers of decayed, missing, and filled permanent teeth were 4.1 if cosmetic crowns and filed teeth were

excluded, 4.4 with inclusion of the crowns, and 9.7 with both crowns and filed teeth included.

The higher basic DMF mean in the mountain people was apparently due to an accelerated loss of teeth from periodontal disease rather than to an increased prevalence of caries. While it was particularly severe in these people, periodontal disease was widespread in the general population as well. Heavy deposits of calculus were present in the mouth of nearly every person aged about 12 years or older. In many of the older people teeth had been coated with a black, relatively permanent lacquer. This was believed to have some protective effect. Betel chewing was a common habit.

The diet was generally soft in consistency. The staple foodstuff was rice, usually highly milled, augmented with vegetables, fish and occasional fowl, rarely with beef or pork. There were indications of deficient or marginal intakes of vitamin A, thiamine, and riboflavin in some areas. Patients with clinical beriberi were not uncommon in hospitals.

Discussion

No consistent patterns of association between nutrition and oral status have been developed in these data, so far as they have been analyzed at this time. Lowered caries prevalence in Ecuadorian adults was related to optimal or high intakes of fluoride. Both high and low levels of caries experience were seen in Eskimos in Alaska with high intakes of animal protein, moderate intakes of fat, and very low intakes of carbohydrates, with generally low plasma levels of vitamin A. Caries prevalence levels as low or lower were seen in Ethiopians on a comparatively low-protein, high-carbohydrate cereal diet, high in thiamine; and in Vietnamese on a diet in which highly milled rice was the staple cereal, yielding only marginal amounts of thiamine and riboflavin. Large proportions of individuals in each group had remained caries free from birth to the time of examination.

If caries prevalence levels were generally low by U.S. standards, the prevalence and severity of periodontal disease were correspondingly high. The only areas where periodontal disease was importantly less prevalent than in the United States were found in Alaska, in men whose thiamine excretion was somewhat higher, and whose levels of plasma vitamin A were somewhat lower than those for other men in that study; and in the primitive Jivaro Indians examined in Ecuador. Elsewhere in Alaska, and generally in Peru, disease levels were comparable with those seen in United States, among people of low socioeconomic status. In Ethiopia, Ecuador, and Vietnam, prevalence levels were much above any so far recorded for the continental United States.

The analysis of relations within and between these studies is continuing. Detailed reports are to be prepared as these analyses are completed.

REFERENCES

(1) Russell, A. L.: Prevention and control of dental caries. *In* Dentistry in public health, edited by W. J. Pelton and J. M. Wisan. Philadelphia, W. B. Saunders Co., 1955, pp. 93–129.

(2) University of Michigan School of Public Health: The practice of dental health. University of Michigan Continued Education Series No. 67. Ann Arbor, Mich., Publications Distribution Service, 1956, pp. 61–75.

(3) Shaw, J. H.: Nutrition and dental caries. *In* A survey of the literature of dental caries. National Academy of Sciences-National Research Council Pub. No. 225. Washington, D.C., 1952, pp. 415–507.

(4) Collins, R. O., Jensen, A. L., and Becks, H.: Study of caries-free individuals. II. Is an optimum diet or a reduced carbohydrate intake required to arrest dental caries? J. Am. Dent. A. 29: 1169–1178, July 1942.

(5) Glickman, I.: Interrelation of local and systemic factors in periodontal disease: bone factor concept. J. Am. Dent. A. 45: 422–429, October 1952.

(6) Russell, A. L., and Ayers, P.: Periodontal disease and socioeconomic status in Birmingham, Alabama. Am. J. Pub. Health 50: 206–214, February 1960.

(7) Russell, A. L.: A system of classification and scoring for prevalence surveys of periodontal disease. J. Dent. Res. 35: 350–359, June 1956.

(8) Stahl, S. S., and Morris, A. L.: Oral health conditions among army personnel at the Army Engineer Center. J. Periodont. 26: 180–185, July 1955.

(9) Greene, J. C., and Vermillion, J. R.: The oral hygiene index—A method for classifying oral hygiene status. J. Am. Dent. A. (In press.)

(10) Baarregaard, A.: Dental conditions and nutrition among natives of Greenland. Oral Surg. 2: 995–1007, August 1949.

(*11*) Rosebury, T., and Waugh, L. M.: Dental caries among Eskimos of the Kuskokwim area of Alaska. I. Clinical and bacteriological findings. Am. J. Dis. Child. 57: 871–893, April 1939.

(*12*) Siegel, E. H., Waugh, L. M., and Karshan, M.: Dietary and metabolic studies of Eskimo children with and without dental caries. Am. J. Dis. Child. 59: 19–38, January 1940.

(*13*) Price, W. A.: Eskimo and Indian field studies in Alaska and Canada. J. Am. Dent. A. 23: 417–437, March 1936.

(*14*) Interdepartmental Committee on Nutrition for National Defense: Ethiopia: Nutrition survey. Bethesda, Md., National Institutes of Health, September 1959.

(*15*) Interdepartmental Committee on Nutrition for National Defense: Manual for nutrition surveys. Washington, D.C., U.S. Government Printing Office, May 1957.

(*16*) Trulson, M. F., Collazos, C., and Hegsted, D. M.: Growth and development of Peruvian children. I. Carquin and San Nicolas. Pediatrics 17: 510–523, April 1956.

(*17*) Trulson, M. F., Collazos, C., and Hegsted, D. M.: Growth and development of Peruvian children. II. Children from two areas—jungle and coastal. J. Am. Dietet. A. 33: 1019–1026, October 1957.

(*18*) Huenemann, R.: Nutrition and care of young children in Peru. I. Purpose, methods, and procedures of study. J. Am. Dietet. A. 30: 554–558, June 1954.

(*19*) Huenemann, R. L., and Collazos, C.: Nutrition and care of young children in Peru. II. San Nicolas, a cotton hacienda, and Carquin, a fishing village in the Coastal Plain. J. Am. Dietet. A. 30: 559–569, June 1954.

(*20*) Huenemann, R. L., and Collazos, C.: Nutrition and care of young children in Peru. III. Yurimaguas, a jungle town. J. Am. Dietet. A. 30: 1101–1109, November 1954.

(*21*) Huenemann, R. L., et al.: Nutrition and care of young children in Peru. IV. Chacan and Vicos, rural communities in the Andes. J. Am. Dietet. A. 31: 1121–1133, November 1955.

(*22*) Commission on Chronic Illness: Prevalence of dental conditions. *In* Chronic illness in the United States. Vol. IV. Chronic illness in a large city. Cambridge, Mass., Harvard University Press, 1957, pp. 107–118.

Abstracting and Indexing Services

Abstracts or title listings of biological and medical articles are currently carried by 310 periodicals published in 34 countries. Of these, 154 are devoted exclusively to abstracts or title listings. The remainder are primary journals that regularly carry at least 200 abstracts per volume.

The five leading countries in terms of number of abstracts and citations published are as follows:

	Abstracting-indexing services	*Abstracts and citations per annum*
United States	73	753, 160
Germany	45	196, 300
Great Britain	36	162, 140
Russia	5	159, 100
France	44	158, 900

English is the language of 120 of the abstracting-indexing services, which together publish more than 1 million abstracts and citations each year. German, French, and Russian are each the language of between 150,000 and 200,000 items. Forty-nine journals carry items in German, 50 in French, and 5 in Russian. Four services publish some 92,000 items in Japanese.

How close these many services come to providing complete coverage of the literature is not known. Overlapping in coverage, certainly in the English language, however, must be considerable, for the total annual publication of biological and medical articles is estimated at less than 400,000.

Abstracting and indexing periodicals are described in a recent publication of the World Health Organization entitled "Current Indexing and Abstracting Periodicals in the Medical and Biological Sciences," issued as a supplement to volume 12 (1959) of *Library News*.

Nutrition of Infants and Preschool Children in Ethiopia

CALVIN W. WOODRUFF, M.D., and KIRK HOERMAN, D.D.S., M.S.

During the nutrition survey in Ethiopia (*1*) several procedures were used to collect information on the nutritional status of infants and preschool children. The nutrition team with the assistance of Ethiopian health officers filled out questionnaires concerning the dietary patterns of infants and children attending the outpatient clinics of three hospitals in Addis Ababa and children at the police training base in Asmara. The questionnaire also contained information on the general health of the infants and some health practices of the people.

Capillary blood samples from about two-thirds of this group and from both preschool and school-age children examined during the latter half of the survey were analyzed for serum proteins, ascorbic acid, and alkaline phosphatase after being shipped to Cairo in the frozen state. The data on growth patterns in infancy, compiled by Dr. Otto Jäger of the public health school at Gondar, are included in this report. The other growth data were collected by the survey team wherever preschool children were examined. The clinical findings for infancy are general impressions based on our own observations and discussions with many physicians throughout the country. Tabulated clinical findings for those preschool children who were examined during the general survey are included.

Dr. Woodruff is with the department of pediatrics, American University Hospital, Beirut, Lebanon. Dr. Hoerman, Commander, Dental Corps, U.S. Navy, is chief of the biochemistry laboratory of Naval Medical Research Unit No. 3, Cairo, Egypt. *The article is based on findings of the nutrition survey conducted in Ethiopia from September to December 1958.*

Dietary Patterns

Nutrient intake records were obtained in Addis Ababa by questionnaire by two health officers and one sanitarian. These workers interviewed the mothers of 34 children at the Mahatma Ghandi Memorial Hospital, of 41 children at St. Paul's Hospital, of 35 children at the Ethiopian-Swedish Pediatric Clinic, of 13 children at the police training base in Asmara, and of 10 children seen during the course of the survey. The selected nature of this sample is to be emphasized, but it provides information of interest.

The mother's age and number of children were recorded. Although the number of children reported usually refers to the number of living children, it is taken as roughly indicative of the mother's parity. The mothers ranged in age from 16 to 49 years at the time they were interviewed. The median maternal age was 27 years. Their median age by number of children was as follows.

Number of children	*Median age of mother (years)*
1	22
2	24
3	28
4	31
5	32
6	32
More than 6	35

The median number of children per family was three. Families with more than four constituted only 8 percent of this sample. The age, number of children, and breast-feeding status of the children whose mothers were interviewed follow.

Age of child (months)	*Number*	*Percent breast fed*
Less than 3	15	82
3–5	14	77
6–11	26	72
12–17	19	54
18–23	20	40
24–35	16	13
36–59	23	9
Total	133	

Fifty-one percent of these children were boys.

Nearly three-quarters of the infants were breast fed for at least 1 year, and more than half for 18 months. That 18 percent of these infants were not breast fed to 3 months may reflect the selected sample obtained in the urban clinics.

Information was recorded concerning the reason for discontinuing breast feeding of 36 infants. The reasons given were: 10 mothers stopped because of an ensuing pregnancy, 6 because of illness, 5 had not established successful lactation, 5 had inadequate milk, 3 interdicted nursing because of maternal tuberculosis, 2 because they were employed outside the home, 2 because the infants were ill, 1 infant was adopted at the age of 6 months, 1 mother had died, and 1 mother stopped nursing "on medical advice."

Supplements to breast feeding consisted of three types of foods: some modification of cow's milk; sugar, cereal, and tea; and foods from the family diet. By the age of 6 months 86 percent of the 133 infants were receiving cow's milk in some form. This often consisted of very small amounts (2 or 3 tablespoonfuls) of powdered milk greatly diluted and fed from a bottle. On the other hand, as much as 1 liter of fresh or evaporated cow's milk was sometimes given to a child. During the second year of life the milk supplement had decreased and, in the 3- to 5-year age group, less than two-thirds of the children were receiving milk in any form, and many of these received but a small amount. Again, the relatively frequent use of milk as a supplement in the first year of life may reflect the special nature of the group sampled at these clinics.

In the 6- to 11-month age group, 4 to 26 infants had milk fortified with cereal and 3 were

Children at Mulu Farm wait for physical examinations

receiving bread, injera (a sourdough pancake made from teff, a local grain similar to wheat), or potato. Two infants in this age group received eggs "frequently." During the second year of life 23 of 39 infants were being fed injera, wat (a hot, highly seasoned stew or thick soup, commonly containing ground red pepper, garlic, onions, butter or oil, potatoes, pulses, and occasionally meat), and bread, and only a very few children received any fruit or eggs. About one-fifth of the infants received nothing but milk even after the age of 2 years, half of these being fed it in the fresh form. The others received only those foods provided by the family diet.

Only one-third of the infants under 1 year of age received boiled water. This is more than one would expect throughout the country as a whole. Only 12 of the 133 infants received vitamins at any time, and of these the majority received vitamin A and D capsules for a limited period. An attempt was made to collect estimates of exposure to sunlight, but this proved unsuccessful. Seventeen percent of the children over 1 year had been given beer.

One-third of those over 12 months of age were reported to eat dirt. This habit disappeared shortly after the age of 2.

Fifteen percent of the children over 1 year had been known to have passed *Ascaris*. Approximately 43 percent of the infants had had at least one attack of diarrhea, and several had experienced repeated episodes.

Diet inquiry at Tessemet during the nutrition survey in Ethiopia

Thirty-three percent of the children over 6 months of age had had the roots of the lower cuspid teeth needled and 39 percent had had the uvula amputated. These practices were even more common in rural areas and are part of traditional folk medicine.

Of the complaints for which children were brought to the clinic, one-quarter were recorded as gastrointestinal and respiratory disturbances. The next most common reasons for consulting a physician were to obtain vaccination or because of malnutrition.

Table 1. Median capillary blood values, Ethiopian infants and children

Blood analysis	Addis Ababa children, 0–5 years		Other Ethiopian children		Total	Range of 10–90 percentile	Number of samples	Range of number of samples per group
	Breast fed	Artificially fed	Preschool[1]	6–17 years				
Packed cell volume	38. 1	40. 8	40. 5	43. 0	40. 0	32–46	150	18–63
Ascorbic acid (mg./100 ml.)	. 12	. 09	. 06	. 07	. 08	0. 00–0. 65	113	13–44
Alkaline phosphatase (nitrophenol units)	6. 6	6. 3	6. 7	5. 8	6. 5	4–11	101	17–35
Total serum proteins (gm./100 ml.)	6. 75	6. 70	7. 60	7. 4	7. 1	5. 8–8. 7	78	12–30
Albumin (gm./100 ml.)	3. 1	3. 1	3. 3	3. 5	3. 2	2. 4–3. 8	74	11–28
Alpha-1 globulin (gm./100 ml.)	. 45	. 45	. 52	. 54	. 49	0. 33–0. 69	74	11–28
Alpha-2 globulin (gm./100 ml.)	1. 20	1. 19	1. 22	. 96	1. 16	0. 66–1. 57	74	11–28
Beta globulin (gm./100 ml.)	. 96	. 95	1. 17	1. 05	1. 04	0. 75–1. 60	74	11–28
Gamma globulin (gm./100 ml.)	. 90	. 85	1. 45	1. 87	1. 30	0. 65–2. 05	74	11–26

[1] Food practices unknown.

Biochemical Findings

Capillary blood samples were collected from these children and analyzed at the Naval Medical Research Unit No. 3 in Cairo. The microchemical methods used for determination of ascorbic acid and alkaline phosphatase were those of Bessey (*2*). Total serum protein determinations were made by a standard biuret method. Electrophoresis was carried out on S and S 2043A paper strips and stained according to the method of Block and co-workers (*3*). The strips were scanned in a Beckman DU spectrophotometer at 575 millimicrons. Results are reported in absolute amounts derived by multiplying the total serum protein by the percentage of the various components. One or more determinations were completed on 100 of the 133 children. In addition, similar capillary blood samples were drawn from 39 infants or preschool children and from 19 school-age children examined during the survey and analyzed by the Navy unit.

The biochemical data obtained from the 133 children whose dietary histories were taken appeared to be similar for the four locations and are combined for presentation. They are subdivided into those children who were breast fed at the time that the sample was taken and those not breast fed. For analysis, the preschool children seen outside of Addis Ababa and the school-age children, 6 to 17 years, are considered separately.

Table 2. Distribution frequency in percent of some biochemical findings among Ethiopian children

Blood analysis	Addis Ababa children, 0–5 years		Other Ethiopian children	
	Breast fed	Artificially fed	Preschool [1]	6–17 years
Albumin (<3.0 gm./100 ml.)	46	48	25	23
Gamma globulin (>1.2 gm./100 ml.)	0	33	79	100
Alkaline phosphatase (>10 units)	26	23	11	6
Ascorbic acid (<0.1 mg./100 ml.)	48	57	90	77

[1] Feeding practices unknown.

Table 3. Average weight of 725 infants, birth through 18 months of age

Age (months)	Number of weighings [1]	Weight (grams)
0	80	3, 290
1	137	3, 795
2	125	4, 493
3	122	5, 140
4	110	5, 501
5	114	6, 119
6	156	6, 281
7	107	6, 415
8	108	6, 798
9	115	6, 931
10	106	7, 169
11	82	6, 947
12	154	7, 374
13	77	7, 324
14	80	7, 633
15	76	7, 726
16	59	8, 165
17	41	8, 185
18	57	8, 148

[1] 1,906 weighings of 725 infants of both sexes.

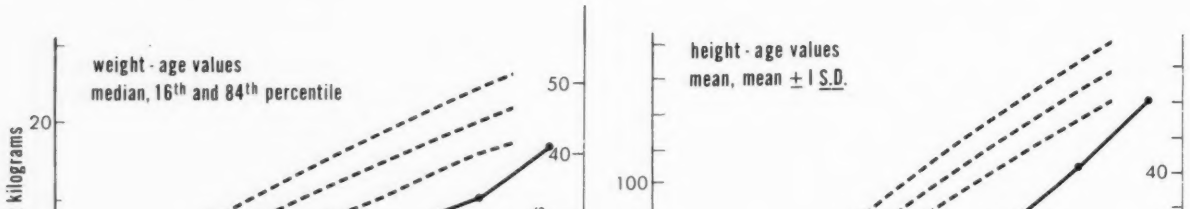
SOURCE: Unpublished data of Otto A. Jäger, M.D., school of public health, Gondar, Ethiopia.

Results of the determinations are given in tables 1 and 2. The packed blood cell volume was below 30 percent in 4 percent of the infants seen in the clinics and in none of the infants and preschool children examined outside of Addis Ababa. Packed cell volumes were slightly lower in the breast-fed infants than in the artificially fed infants under 2 years of age. This may reflect the high iron content of the cereals eaten. Two of the school-age children had packed cell volumes of less than 36 percent.

The ascorbic acid concentration in the serum was less than 0.1 mg. per 100 ml. in 53 percent of the children on whom dietary histories were obtained. There were no meaningful differences between breast-fed and artificially fed children. Only 6 of 113 infants had ascorbic acid concentrations greater than 0.7 mg. per 100 ml. Among the preschool children examined elsewhere and among school children, 90 and 77 percent respectively had less than 0.1 mg. per 100 ml. of ascorbic acid in their serum.

The serum alkaline phosphatase activity was elevated above a high normal level of 10 nitrophenol units per liter in 23 and 26 percent of the artificially fed and breast-fed infants respectively. Among the preschool children ex-

Average height and weight of Ethiopian boys 0 to 6 years of age compared with U.S. standards



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amined as part of the regular survey, only 11 percent had elevated values and only one of the school children had a high value. Two of the preschool children had values above 30 nitrophenol units per liter, indicative of highly abnormal activity.

The total serum protein was determined on 78 infants and children. No differences were found between those breast fed and artificially fed. The serum albumin as determined electrophoretically was less than 3.0 gm. per 100 ml., a definitely subnormal value, in approximately one-half of the infants and one-quarter of the preschool and school children.

The alpha-1 globulin levels were within limits accepted as normal according to current American standards (*4*), while the alpha-2 and beta globulin values were elevated. In the breast-fed infants the median gamma globulin was 0.9 gm. per 100 ml. with little variability. Among the artificially-fed infants the median value was almost the same, but there were more values above 1.2 gm. per 100 ml. The median gamma globulin value for the preschool infants outside of Addis Ababa was 1.4 grams percent. For the school children the median value was 1.8 grams percent, with all of the values falling above 1.2 grams percent. The variation in the total serum protein among these groups was in large part due to the variation in gamma globulin levels.

Growth Patterns

The growth of Ethiopian infants has been documented by Dr. Otto Jäger of the public health school at Gondar. He tabulated weights of infants between birth and 18 months of age (table 3). These infants appear to have relatively satisfactory growth rates until the age of 5 or 6 months, at which time the gain in weight becomes very slow.

Data obtained during the nutrition survey extended these observations and demonstrated that growth failure persisted throughout the growth period (see chart). The chart shows the height and weight of Ethiopian boys compared with children in the United States. The Iowa growth curves were used as an arbitrary standard since suitable growth curves for Ethiopia were not available. Ethiopian children cared for by Swedish parents grew in keeping with European growth standards (personal communication, Dr. Edgar Maanheimer of the Ethiopian-Swedish Pediatric Clinic).

Clinical Findings

Discussion with physicians interested in children in Addis Ababa and elsewhere in Ethiopia

resulted in a rather widely agreed-upon estimate that the incidence of rickets is about 30 percent at the age of 1 year. Rickets appears to be mild in its clinical manifestations in almost all the areas visited, since permanent rachitic deformities were rare. Rickets disappear after the age of 2 to 3 years. Usually, young infants do not receive either vitamin D supplementation or adequate exposure to sunlight until after they learn to walk and to fare for themselves. The available data on the serum alkaline phosphatase levels are compatible with this hypothesis.

Protein malnutrition was seen frequently in all the pediatric clinics visited, although the manifestations of red hair and severe dermatosis were rare. There appeared to be a higher incidence of protein malnutrition among the hospital population in Asmara than in Addis Ababa. In Asmara the survey team observed four instances of protein malnutrition in the pediatric ward on one visit and eight on another. The frequency with which children with protein malnutrition are brought for specific medical attention probably does not represent the true incidence of the condition, particularly since low serum albumin levels were found in half of the infants tested and growth retardation in the preschool group was very common. Abnormally low serum albumin concentrations were found among the school children also.

Inquiries concerning other deficiency diseases in childhood were made. Occasional cases of scurvy were reported in Addis Ababa. None was seen during this survey. No clear instance of avitaminoses of the B-complex had been recognized, and anemia is relatively uncommon except as associated with malaria or hookworm infestations in some of the lowland areas. Neither of these diseases was found with any great frequency among the populations from which the preschool children were drawn.

The incidence of diarrhea in the infant population was difficult to assess except that it made up 40 to 50 percent of the hospital admissions in the preschool age group and accounted for a high percentage of the clinic visits. The association of recurrent bouts of diarrhea with protein malnutrition has been noted wherever protein malnutrition exists, and it is suggested that a similar association occurs in Ethiopia.

In the course of the survey 432 children less than 5 years of age were given an abbreviated clinical examination, and on 53 of these detailed physical examinations were done. The findings have been presented in table 4. By comparison with the total population group (*1,5*) there

Table 4. Comparison of clinical findings in examinations of infants and preschool children with findings in total survey sample over 15 years, by percent

Clinical findings	0–4 years		5–14 years		Over 15 years	
	Male N=221	Female N=211	Male N=1,371	Female N=697	Male N=2,497	Female N=813
Glands: Thyroid enlarged	0.5	0.0	2.5	5.1	2.4	12.2
Skin, face, and neck: Nasolabial seborrhea	.0	.0	.1	.1	22.5	9.8
Eyes: Bitot's spots	.0	.0	2.6	.1	1.5	.6
Lips:						
Angular lesions	1.4	3.3	1.2	.1	.5	.5
Angular scars	2.3	1.4	5.1	6.1	6.6	8.4
Cheilosis	2.7	4.3	4.9	5.2	4.0	3.9
Tongue: Filiform papillary atrophy, moderate or severe	.9	.5	4.1	.1	1.3	2.5
Gums:						
Marginal redness or swelling [1]	11.5	14.8	52.6	36.7	50.5	45.8
"Scorbutic-type" gums	.5	.9	1.3	.1	1.0	.7
Skin, general: Follicular hyperkeratosis	1.8	2.8	11.6	5.2	4.4	2.5
Lower extremities:						
Bilateral edema	1.8	.5	.1	2.2	1.4	5.7
Loss of ankle jerk	.9	1.4	2.2	1.4	3.9	3.9
Calf tenderness, moderate or severe	.0	.0	.1	.1	.3	.6

[1] These data obtained from detailed examinations.

were several differences which may be attributable to age.

There was a low incidence of thyroid enlargement among these children, only one instance being recorded. Nasolabial seborrhea was not noted in this age group. Bitot's spots were not seen. The relatively high incidence of conjunctival injection was due to conjunctivitis. The incidence of follicular hyperkeratosis was lower in this age group than in older children, particularly for the boys.

Lesions at the angles of the lips were more common in this age group than in any other, with an incidence of 3.3 percent in the girls. Edema was not as frequent a finding in these young children as had been expected on the basis of the serum albumin levels.

The other clinical observations have an incidence pattern that does not appear to differ significantly from the rest of the Ethiopian population observed. No scurvy, beriberi, pellagra, or xerophthalmia was observed.

Summary and Conclusions

The dietary histories are representative of infants living in cities who attended clinics, and cannot be considered representative for the country as a whole. The food practices reflect a degree of sophistication beyond that to be expected generally. The feeding pattern consisted of breast feeding for periods of 18 months or longer for almost half the infants. Supplements of cow's milk were given to more than 80 percent of the children at some time during the first year of life and somewhat less frequently thereafter. Supplementary foods used were mainly injera, bread, and tea. By the age of 2 years the child usually ate the adult diet, but in some instances still received only milk.

The laboratory assessment of the nutritive status of this group of preschool and school children warrants several conclusions. Anemia was relatively uncommon. The intake of ascorbic acid resulted in high blood levels of vitamin C in only 5 percent of the group and deficient levels in 65 percent. The alkaline phosphatase activity was elevated in 11 to 26 percent of the preschool children but in only one school child. The serum proteins showed greater variability than would be expected in healthy individuals, with an excess of both low and high values. The serum albumin level was abnormally low in one-half of the infants and one-quarter of the preschool and school children. The alpha-2 and beta globulin values were almost universally elevated, and the gamma globulin was elevated in all but the breast-fed infants examined in Addis Ababa. It is suggested that the increase in gamma globulin levels may result from the increased number of contacts with infectious or parasitic disease, which seems more likely to occur in artificially fed infants. From the laboratory assessment it appears that there are widespread low intakes of ascorbic acid, that the clinical evidence of common mild rickets is supported, and that the hypoalbuminemia and hyperglobulinemia may reflect environmental influences, including nutrition. There is little nutritional anemia among these infants and preschool children.

The growth observations are similar to those reported from other areas of the world where protein malnutrition is common, where preclinical kwashiorker exists, and infant- and child-feeding practices are similarly unsatisfactory.

The most common nutritional diseases seen in infancy were rickets and protein malnutrition. The association of edema, marasmus, and diarrhea was encountered frequently. Growth failure was almost universal in the preschool children, although incidence of specific nutritional disease in this age group was low in those brought for examination.

REFERENCES

(1) Interdepartmental Committee on Nutrition for National Defense: Ethiopia: Nutrition survey. Bethesda, Md. National Institutes of Health, September 1959.

(2) Bessey, O. A.: Microchemical methods. *In* Vitamin methods, edited by Paul György. New York, Academic Press, 1950, vol. 1, pp. 303–305. 313–316.

(3) Block, R. J., Durrum, E. L., and Zweig, G.: A manual of paper chromatography and paper electrophoresis. Ed. 2. New York, Academic Press, 1955, pp. 391–405.

(4) Harvie, F. H.: Pediatric methods and standards. Philadelphia, Lea and Febiger, 1958.

(5) Darby, W. J., et al.: Bitot's spots and vitamin A deficiency. Pub. Health Rep. 75: 738–743, August 1960.

Endemic Goiter in Latin America

NEVIN S. SCRIMSHAW, Ph.D., M.D., M.P.H.

Interest in the problem of endemic goiter in Latin America has been greatly stimulated by the series of FAO-WHO conferences on the nutritional problems of Latin America, held successively in Montevideo in 1948 (*1*), Rio de Janeiro in 1950 (*2*), Caracas in 1953 (*3*), and Guatemala City in 1957 (*4*). Each of these recommended that surveys for the detection of endemic goiter be carried out in all of the countries of Latin America, and made it apparent that endemic goiter was a serious public health problem in the great majority of them. As a result, a large number of surveys have been published, and the information on the distribution of endemic goiter in the hemisphere has become increasingly complete.

The report of the third Latin American nutrition conference (*3*) deserves special attention since a third of it was devoted to a complete analysis of the problem of endemic goiter in the Americas, including not only prevalence, contributory factors, and public health significance, but also practical details of prevention and treatment. The demonstration by Góngora and Mejía Caicedo (*5*) of the effectiveness of iodization of salt in the State of Caldas, Colombia, and the work of the Institute of Nutrition of Central America and Panama on the practical value of potassium iodate for the iodization of crude, moist salt (*6*, *7*) have widespread significance. Attention should also be given to the metabolic investigations of Stanbury (*8*), carried out mainly in the Province of Mendoza in Argentina. More recently, epidemiological studies carried out in Brazil (*9*, *10*) and Ecuador (unpublished data of the National Institute of Nutrition) have shed further light on environmental factors in the occurrence of endemic goiter.

Extensive reviews of the occurrence of endemic goiter in Latin America were published in 1950 (*11*) and 1954 (*12*). A Bulletin of the World Health Organization, published in 1958 and devoted entirely to the problem of endemic goiter (*13*), contained a systematic survey by Kelly and Snedden of the world prevalence and geographic distribution of endemic goiter, including Latin America.

Dr. Scrimshaw is regional adviser in nutrition, Pan American Health Organization, and director of the Institute of Nutrition of Central America and Panama, Guatemala City.

Distribution in Latin America

Argentina. Endemic goiter is prevalent in the Provinces of San Juan, La Rioja (*14*, *15*), Catamarca, Jujuy (*14–16*), Córdoba, Corrientes (*17*), Neuquén (*14*, *15*, *17*), and Misiones (*15–17*). In Formosa, examination of 3,800 students showed a prevalence of 69 percent, and 38,000 students in Mendoza had a frequency of 19 percent (*18*). Other studies (*14–16*, *18*, *19*) have reported prevalence figures as low as 12 percent and as high as 73 percent, according to the locality. In the Province of Salta, 87 percent of the boys and 88 percent of the girls examined in a group of 1,300 students had goiters

(*20*). Tucumán (*1*) had an average prevalence of 75 percent; 65 percent in the boys and 61 percent in the girls among the 1,800 students examined (*18*). It was also stated that 0.44 percent of this group were mentally retarded. Many of the authors cited cases of feeblemindedness, cretinism, and deaf-mutism as well.

Bolivia. The most recent and complete study (*21*), published in 1946, gave a prevalence of 40 percent or more in the Provinces of Zudáñes, Oropeza, Azurduy, Boeto, Vallegrande, Chiquitos, and Cordillera y Tacuaremboti. In Azurduy, cases of goiter occurred among the newborn. The Tacuaremboti inhabitants were known as "los cotudos de Tacuaremboti." La Paz, Cochabamba, Potosí, and Santa Cruz described endemic goiter as frequent, and it was also observed in Oruro. In Tarija, the following frequencies were observed among the students of four localities: Ríos 60 percent, San Lorenzo 50 percent, Padcaya 30 percent, and Concepción 33 percent (*22*). Duguid (*23*) states that near the Rio Grande "all the women suffer from goiter," and Fernández (*24*) mentions that in the village of Cotoca, near the city of Santa Cruz, all stages of cretinism were found.

Brazil. In Matto Grosso (*25*, *26*), as well as in Minas Gerais (*27*, *28*), Paraná (*29*), Sao Paulo (*30–35*), and Rio de Janeiro (*36*), very high prevalence figures for endemic goiter have been reported. According to Lobo Leite (*27*), the frequency for all the State of Minas Gerais is 44 percent. Lobo Leite also encountered cretins, deaf-mutes, and the mentally deficient. A recent survey by Barca Pellon and others (*37*) of 866,217 school children between the ages of 5 and 17, included 20 States, 4 Territories, and the Federal District. The survey gave the following prevalence figures: north 9.4 percent, western northeast 6.0 percent, eastern northeast 0.6 percent, northeast 0.9 percent, southeast 27.0 percent, mideast 53.8 percent, and south 27.7 percent. In some of the communities surveyed the prevalence was over 80 percent.

Chile. It is probable that goiter is highly endemic in the regions situated at the foot of the mountains, along the rivers Aconcagua, Maipó, Cachapoal, and Teno (*38*). The disease is not restricted to the valleys of the Andes since a third of the persons examined in the village of California had goiter, and a relatively high prevalence occurred also among the residents of Doñihue, Cerrillos, and other neighboring localities (*39*). Goiter occurred also in Teno, near Curicó (*40*), in Chimbarongo (*38*), and in La Punta, Province of O'Higgins (*41*). A survey by Donoso and others (*42*) of school children in the Province of Santiago, gave a prevalence of 11 percent in 39,433 examined, with variation from 0 to 37 percent. These authors believed that the prevalence of endemic goiter was increasing in Chile.

Colombia. In Colombia, the problem of endemic goiter has been recognized for many years and studied intensively. Citing only the more recent studies, Caycedo in 1946 reported goiter in 89 percent of 5,000 students in the Department of Cauca, 81 percent of 25,000 in Caldas, 67 percent of 5,000 in Boyacá, 75 percent of 200 in Santander del Sur, and 71 percent of 12,500 in Valle (*43*). From 1945 to 1948, almost 185,000 students from all over the country were examined and a prevalence of 53 percent was encountered (*44*). A subsequent report (*8*) classified the Departments of the Atlantic Coast, Atlantico (23 percent), Magdalena (24 percent), and Bolívar (29 percent), as zones of "low" prevalence; the Departments of Nariño (38 percent), Santander del Sur (47 percent), Valle (53 percent), and Boyacá (58 percent) as zones of "medium" prevalence; and the Departments of Huila (69 percent), Cauca (80 percent), and Caldas (81 percent) as having "high" prevalence.

Costa Rica. In 1956, Pérez and others (*45*) reported the results of examinations among 26,768 school children in all 7 Provinces of Costa Rica as follows: Guanacaste 26 percent, Puntarenas 20 percent, Alajuela 20 percent, Heredia 15 percent, San José 12 percent, Cartago 12 percent, and Limón 10 percent. In addition they found a higher prevalence of goiter in females than in males, and in rural areas than in urban areas.

Ecuador. An overall goiter prevalence of 50.5 percent was reported in the surveys conducted by the National Institute of Nutrition (unpublished data) among nearly 5,000 individuals from Quito and 10 rural communities in the Province of Pichincha. The prevalence in women was shown as 56 percent, in men 45

percent, and 58 percent in school children. Of the goiters recorded, 28 percent were grade 2 and nearly 14 percent were grade 3, according to the WHO classification (*46*). In Ecuador, cases of cretinism have been observed since 1824 (*47*).

El Salvador. Studies among nearly 24,000 school children in urban areas and 9,000 in rural areas, which included 14 Departments of the country, showed an average prevalence of endemic goiter of 30 percent and 29 percent respectively (*48,49*). One Department (Ahuachapán) had a frequency of 26 percent in the capital city and 54 percent in rural areas. The 8,000 children examined in the National Capital had only 1 percent endemic goiter, reducing the general average. No cases of cretinism, deaf-mutism, or idiocy were reported.

Guatemala. Of the total of 39,484 persons examined in all 22 Departments, representing 1.4 percent of the population (*50*), 28 percent were adults, 70 percent were school children, and 2 percent preschool children. The overall goiter prevalence of 38.5 percent was the highest in Central America. The averages in each Department were: Baja Verapaz 64 percent, Chimaltenango 59 percent, Sacatepéquez 56 percent, San Marcos 54 percent, Totonicapán 45 percent, Quiché 44 percent, Alta Verapaz 42 percent, Santa Rosa 39 percent, Retalhuleu 38 percent, Suchitepéquez 37 percent, Sololá 37 percent, Huehuetenango 37 percent, Jutiapa 36 percent, Escuintla 34 percent, Chiquimula 33 percent, Quezaltenango 30 percent, Progreso 30 percent, Guatemala 28 percent, Zacapa 22 percent, Jalapa 22 percent, Izabal 20 percent, and Petén 7 percent. The prevalence of endemic goiter tended to increase with altitude.

Honduras. A survey by Borjas (*51*) on 12,644 persons in 15 Departments showed an overall prevalence of 22 percent with the following age distribution: children, ages 6 to 12, showed a frequency of nearly 16 percent in boys and 23 percent in girls, while in the adolescent group, 13 to 18 years, the frequency was 19 percent in boys and 30 percent in girls. In adults, 19 years and over, there was a frequency of 52 percent in males and 41 percent in females. Departments with the highest prevalence rates were: Lempira 46 percent, Santa Bárbara 43 percent, Francisco Morazán 41 percent, Valle 36 percent, Choluteca 23 percent, La Paz 18 percent, Ocotepeque 17 percent, Copán 15 percent, and El Paraíso 13 percent.

Mexico. Stacpoole (*52*) reported that in more than 1 million persons in the eight central States there was an overall prevalence of 19 percent. On the basis of reports of public health physicians, he believed that, except for Lower California, the whole country was affected, although the frequency was less in the north central and coastal States. He estimated that at least 3 million persons in Mexico had endemic goiter.

Nicaragua. Arce Paiz and Pérez (*53,54*) reported a prevalence of 26.5 percent among 15,500 persons in a survey covering the whole country. The prevalence was over 30 percent in the Departments of Chinandega, Estelí, Madriz, Matagalpa, Nueva Segovia, and Rivas; 20–30 percent in the Departments of Carazo and Managua; and 10–20 percent in the remaining five Departments of Boaco, Chontales, Jinotega, León, and Masaya.

Panamá. W. Ascoli and his associates have reported in unpublished data that in 1958 a national survey of 7,578 school children showed an overall prevalence of 31.5 percent. The frequency, by Provinces, was: Coclé 26.4 percent, Colón 17.4 percent, Chiriquí 61.5 percent, Bocas del Toro 5.2 percent, Veraguas 67.5 percent, Herrera 26.9 percent, Los Santos 62.8 percent, Panamá 15.8 percent, and Darién 8.3 percent. These figures are similar to those reported previously by Reverte in his surveys in the Provinces of Herrera, Veraguas, Coclé, Panamá, and Colón (*55–59*).

Paraguay. Of 13,000 school children between the ages of 6 and 16 years examined in 35 towns of this country, 30 percent had endemic goiter (*60*). Extensive examinations carried out by national health service physicians indicated a relatively high frequency of goiter and a considerable number of children with suggestive signs of cretinism (*61*).

Perú. In 1938 Burga Hurtado (*62*) reported a goiter prevalence of 90 percent in the lower zones and 30 percent in the higher altitudes in the Department of the Amazon. Salazar published an extensive monograph in 1952 (*63*) on personal investigations for the northern, central, and southern areas of the country, in-

cluding parts of the coast, mountains, and jungles. He found an overall goiter prevalence of 36 percent in men and 64 percent in women, as well as cretins, idiots, and some deaf-mutes. Burga Hurtado (*64,65*) has reported that in some areas of the Province of Rodríguez de Mendoza the prevalence reached 100 percent, while in the Department of Ancash it was less than 10 percent. The highest prevalence was found at altitudes between 1,000 and 3,000 meters.

Uruguay. In spite of previous reports that endemic goiter does not exist in Uruguay, a survey by Bauza and others (*66*) among school children in five of the eastern Departments of the country showed that endemic goiter prevalence varied between 6 and 17 percent.

Venezuela. In 1941 (*67*) a questionnaire concerning goiter was filled out by the authorities in a number of towns. Eight of the replies indicated a prevalence of endemic goiter greater than 10 percent. La Grita with 47 percent, Guarico with 28 percent, and Monte Carmelo with 25 percent, had the highest frequencies among the localities that responded. In La Grita, cretinism was reported in 2 percent of the school children, and four other towns also reported cases of both cretinism and deaf-mutism. In a study of endemic goiter which included uptake of labeled iodine (I^{131}), Roche and others (*68*) reported that the community of Bailadores, situated in the western mountains of the country, showed a prevalence of 81 percent in adult men, 89 percent in adult women, 77 percent in boys, and 85 percent in girls.

Caribbean Islands. The clinical nutrition surveys that have been carried out in Jamaica, Cuba, Haiti, Puerto Rico, and other islands of the Caribbean do not list endemic goiter as a public health problem.

Effectiveness of Salt Iodization

One of the best demonstrations of the effectiveness of the iodization of common salt for the prevention of endemic goiter carried out anywhere in the world has been reported by Góngora and Mejía Caicedo (*5*). In the Province of Caldas, Colombia, the distribution of salt iodized with potassium iodate at a level of 1 part of iodine in 20,000 parts of salt resulted in a decrease in the prevalence of goiter from 83.1 percent among 8,000 school children in 1945 to 33 percent among 6,500 in 1952. Confirmation of the effectiveness of iodine supplied at the level obtained by salt iodization in the prevention of goiter under conditions prevailing in Latin America comes from the studies in El Salvador and Guatemala (*6*). Five milligrams of iodine given once a week in tablet form, either as potassium iodide or potassium iodate, resulted in a very marked reduction in the prevalence of goiter among school children in periods as short as 15 weeks. No change was observed in groups given placebos. Goiter returned during the school vacation when iodine administration could not be continued.

The significance of this study was in the demonstration that potassium iodate is sufficiently stable to be added to crude, moist salt without the necessity for either refining or special packaging (*6*). Stacpoole has also reported good results with salt sprayed with potassium iodate and administered to 200 school children in San Andrés, Totopec, Mexico (*52*). On the basis of these studies, the third conference (*3*) recommended "that when a dry refined salt containing suitable stabilizers and protected from moisture cannot be conveniently and economically distributed, potassium iodate should be employed for iodization," and most technically underdeveloped areas are now using or plan to use potassium iodate rather than potassium iodide for the iodization of salt. It is hoped that in the next few years reports of repeat surveys will be published after national iodization programs have been introduced.

There is no definite information available on the operation of goitrogenic factors in Latin America. Thus far, iodine administration has been effective in reducing goiter prevalence wherever it has been tried, but the levels employed have been 5 to 10 times higher than in Europe. The natural levels of iodine in some freshly produced salt samples in areas of Latin America where goiter is highly prevalent approach the level of 1 part in 100,000 recommended by the WHO study group which met in London in 1952 (*46*). The third conference took the position that salt iodization for Latin America should be at a level of not more than the 1 part in 10,000 used in the United States

and Canada, and not less than the 1 part in 20,000 used successfully in Colombia. Until clear-cut evidence is available that lower levels are equally effective and that goitrogenic factors are not important in Latin America, this seems a reasonable recommendation in view of its low cost and complete safety.

Lowenstein (*10*) has reported the results of a longitudinal nutrition study among 75 families representing 347 persons living in the Brazilian Amazon community of Belterra whose extremely low cash income was increased threefold from 1955 to 1956 with a corresponding marked improvement in dietary intake of essential nutrients. Coincident with this change the size of the goiters decreased although there was no significant change in overall prevalence. The author believes the changes to have been due to the general nutritional improvement rather than increased dietary iodine content alone, but no analyses of dietary iodine were made. An unpublished study by the National Institute of Nutrition of Ecuador reported that half of 200 individuals in 5 villages had 24-hour urinary iodine excretions below normal limits. Since some individuals with goiter had values which were apparently normal, the authors suspect that goitrogenic factors may be contributing to endemic goiter in this area. Individuals with goiter were found consistently to have abnormally rapid uptakes of labeled iodine (I^{131}).

Progress of Salt Iodization in Latin America

In Paraguay, effective and complete iodization of salt with potassium iodate is required by law and is carried out under the direct supervision of the nutrition section of the health department. In Guatemala, compulsory iodization of salt with potassium iodate was begun in 1958 and is now reasonably complete. At the time of the fourth Latin American nutrition conference in 1957, legislation requiring the iodization of all salt had also been passed by Colombia, Costa Rica, Ecuador, and Panama, but was not yet enforced. In addition, Argentina, Brazil, and Uruguay had legislation requiring the iodization of salt for those regions in which goiter was a public health problem. This has been defined as a prevalence greater than 10 percent. Nearly all the other countries have legislation pending to require salt iodization, but delays have been due not only to inertia, but also to the very real difficulty of arranging for iodization of the output of a large number of very small producers. Continued slow but steady progress toward salt iodization throughout Latin America can be anticipated.

Conclusions

Endemic goiter occurs as a serious health problem in the countries of Bolivia, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panamá, Paraguay, Perú, and Venezuela, and in extensive areas of Argentina, Brazil, Chile, and Uruguay. Since it is known to occur also in the United States and Canada, it is thus a problem of concern to all of the Americas. Cretinism, deaf-mutism, and feeblemindedness are frequently reported in association with a high prevalence of endemic goiter, but there is still no direct evidence for causal relationship.

The importance of salt iodization as a preventive measure is widely recognized, and legislation requiring it is already in effect in 9 of the 20 Latin American countries, although it has not yet been put into practice in all of them. The level of iodization recommended for Latin America by successive nutrition conferences is not less than 1 part of iodine in 20,000 and not more than 1 part in 10,000 parts of salt. The former proved effective in Colombia and the latter is used in the United States and Canada; both are higher than used in Europe. While environmental goitrogenic factors are presumed to increase requirements for iodine in Latin America, there is only speculation as to their possible nature or relative importance. In general, potassium iodate is preferred because it is stable when added to crude moist salt and it requires no special refining or packaging.

REFERENCES

(*1*) Conferencia de Nutrición. Montevideo, julio de 1948. Montevideo, Comisión de Alimentación, Filial de la FAO, 1950.

(*2*) Conferencia sobre los problemas de nutrición en la América Latina, 2da. Rio de Janeiro, Brasil, del 5 al 13 de junio de 1950. FAO informe. Washington, D.C., 1950.

(*3*) Conference on nutrition problems in Latin America, 3d. Caracas, Venezuela, October 19–28, 1953. FAO report. Rome, 1954.

(4) Conference on nutrition problems in Latin America, 4th. Guatemala City, September 23 to October 1, 1957. FAO report. Rome, 1959.
(5) Góngora y López, J., and Mejía Caicedo, F.: Dos años de tratamiento del bocio simple con sal yodada en el Departamento de Caldas. Medicina y Cirugía (Colombia) 16: 357–371 (1952).
(6) Scrimshaw, N. S., Cabezas, A., Castillo, F., and Méndez, J.: Effect of potassium iodate on endemic goitre and protein-bound iodine levels in school-children. Lancet 2: 166–168 (1953).
(7) Arroyave, G., Pineda, O., and Scrimshaw, N. S.: The stability of potassium iodate in crude table salt. Bull. World Health Organ. 14: 183–185 (1956).
(8) Stanbury, J. B.: Iodine metabolism and physiological aspects of endemic goitre. Bull. World Health Organ. 18: 201–215 (1958).
(9) Lowenstein, F. W.: Endemic goiter and nutrition. I. A study of some aspects of their relationship in a Brazilian Amazon community. Am. J. Clin. Nutrit. 7: 331–338 (1959).
(10) Lowenstein, F. W.: Endemic goiter and nutrition. II. A follow-up study of 75 families in a Brazilian Amazon community. Am. J. Clin. Nutrit. 7: 339–348 (1959).
(11) Bocio en la América Latina. Trabajo presentado a la Segunda Conferencia Latinoamericana de Nutrición, Río de Janeiro, junio de 1950. Oficina Educacional de Yodo. Cooperación de Ventas de Salitre y Yodo de Chile.
(12) Scrimshaw, N. S.: El bocio endémico en la América Latina. Bol. Ofic. san. panam. 36: 277–287 (1954).
(13) Kelly, F. C., and Snedden, W. W.: Prevalence and geographical distribution of endemic goitre. Bull. World Health Organ. 18: 5–173 (1958).
(14) Salas, S. M. de, and Amato, F. D.: Contribución al estudio de la endemia bociosa en el país. Rev. Adm. Nac. Agua (Argentina) 10: 101–113 (1946).
(15) Salas, S. M. de, and Amato, F. D.: Contribución al estudio de la endemia bociosa en el país. Semana méd. (Argentina) 53: 597–606 (1946).
(16) Secretaría de Salud Pública: El bocio en la República Argentina, 1939–1945; Estadística preparada por el Gabinete de Investigaciones Técnicas. Arch. Secret. Salud Pública 1: 56–59 (1946–47).
(17) Alonso, M. J. C.: Geografía médica. Bol. san. Dep. nac. hig., Buenos Aires 3: 63–88 (1939).
(18) Perinetti, H.: Bocio endémico (sus proyecciones sociales). Clase dictada el 9–XI–49 en el curso para graduados en endocrinología, cátedra del Prof. E. B. del Castillo, organizada por la Asociación Médica Argentina.
(19) Perinetti, H.: Bocios (con especial referencia a lo encontrado en Mendoza). Bol. Soc. méd., Mendoza 1: 49–103 (1945).
(20) Lewis, J. T.: Características del bocio endémico en las provincias del Norte, Argentina, Semana méd. (Argentina) 2: 713–718 (1924).
(21) Balcázar, J. M.: Epidemiología Boliviana. La Realidad Sanitaria en Bolivia, 1946. Patiño, La Paz. Fundación Universitaria S. I., 1946, pp. 231–235.
(22) Villa, J.: Datos inéditos. Cited by Balcázar (see reference 21).
(23) Duguid, J.: Green hell. A chronicle of travel in the forests of Eastern Bolivia. London, 1931.
(24) Fernández, M. E.: La patología regional del oriente boliviano. Prensa méd. Argent. 32:151–158 (1945).
(25) Arruda Sampaio, A. de: Bocio endémico em alguns municipios do Estado de São Paulo. Rev. paulista de med. 19: 1–14 (1941).
(26) Castro, J. de, and Mattoso, I. V.: A iodetação do sal no profilaxia do bocio endémico. Resenha clín.-cient. 15: 317–323 (1946).
(27) Lobo Leite, A.: O bocio endémico em Minas Gerais. Un ensaio de prevenção pelo iodo. Mem. Inst. Oswaldo Cruz 38: 1–20 (1943).
(28) An experiment in the prevention of endemic goiter. J.A.M.A. 122: 633 (1943).
(29) Duarte Nunes, A.: Do bocio endémico no Paraná. Med. cir. pharm. Brazil (parte 2): 317–326 (1938).
(30) Lyra, A., and Melo e Alburquerque, A. de: Inquéritos sobre a incidencia do bocio endémico nos escolares dos municipios de Botucatu e Campinas. Arq. hig. e saúde púb. (São Paulo) 8: 59–70 (1943).
(31) Melo e Alburquerque, A. de: Pesquisa do bocio endémico no meio escolar de Campinas e Municipio (nota previa). Arq. hig. e saúde púb. (São Paulo) 9: 107–131 (1944).
(32) Arruda Sampaio, A. de: Bocio nos escolares de São Paulo. Pediat. prát. (São Paulo) 11: 215–236 (1940).
(33) Arruda Sampaio, A. de: Novos dados sobre o bocio endémico no estado de São Paulo. Rev. paulista de med. 30: 31–38 (1947).
(34) Arruda Sampaio, A. de: Estudo epidemiológico do bocio endémico em São Paulo. An. paulist. med. e cir. 65, 66: 69–71 (1943).
(35) Arruda Sampaio, A. de: Estudo epidemiológico do bocio endémico em São Paulo. Rev. paulista de med. 21: 321–325 (1942).
(36) Pathology and clinical treatment of the thyroid. J.A.M.A. 126: 186 (1944).
(37) Barca Pellon, A., Silva, W., Borges, P., and Gualberto, V.: Areas bocígenas do Brasil. Arq. brasil. Nutrição 11: 9–43 (1955).
(38) Romero, H.: El bocio como problema de salubridad. Rev. Chilena de hig. y med. Prev. 5: 423–440 (1943).
(39) Peterman, E.: Trabajo presentado al 5o. Congreso Americano de Cirugía. Cited by Romero (see reference 38).
(40) Alvarez, A. J.: El problema del bocio y del

cretinismo en la región de Teno. Medicina Moderna, Valparaíso 4: 697–704 (1930).

(41) Cabello, R. J., and Zúñiga, C. J.: Estudio de la composición mineral de la tierra y del agua en un distrito bocígeno de Chile. Rev. de méd. y aliment. 2: 42–46 (1935).

(42) Donoso, F., Jadresic, A., López, E., García de los Ríos, M., Concha, J., Espejo, M., González, H., Valenzuela, J., and Wainstein, E.: Encuesta de bocio en escolares de la provincia de Santiago y Consideraciones sobre el problema del bocio endémico. Rev. med. de Chile (supp. 6): 1–20, October 1955.

(43) Caycedo, R. J.: Contribución al estudio etiológico y tratamiento del bocio simple en algunas regiones del país. Tesis de la Facultad de med. de Bogotá 8: 71 (1946).

(44) Parra, H.: Bocio simple en Colombia. Rev. Colombia Pediat. 8: 176–178 (1948).

(45) Pérez, C., Salazar-Baldioceda, A., Tandon, O. B., and Scrimshaw, N. S.: Endemic goiter in Costa Rican school children. Am. J. Pub. Health 46: 1283–1286 (1956).

(46) WHO Study Group on Endemic Goiter: Final report. Bull. World Health Organ. 9: 293–301 (1953).

(47) Humboldt, A. von: Observations sur quelques phénomenes peu connus qu'offre le goitre sur les tropiques, dans les plaines et sur les plateux des Andes. J. physiol. exper. Path. 4: 109–118 (1824).

(48) Pineda, T.: Nuevos datos sobre la incidencia del bocio endémico en El Salvador. Sanidad en El Salvador 2: 318–323 (1951).

(49) Cabezas, A., Pineda, T., and Scrimshaw, N. S.: Endemic goiter in El Salvador school children. Am. J. Pub. Health 43: 265–268 (1953).

(50) Muñoz, J. A., Pérez, C., and Scrimshaw, N. S.: Endemic goiter in Guatemala. Am. J. Trop. Med. & Hyg. 4: 963–969 (1955).

(51) Borjas, E. A.: Informe general sobre bocio endémico en Honduras y recomendaciones para su prevención. Rev. med. Honduras 23: 957–964, May–July 1955.

(52) Stacpoole, H. H.: La profilaxis del bocio endémico en México. Bol. Ofic. san. panam. 36: 288–295 (1954).

(53) Arce Paiz, A., and Pérez, A. C.: Informe preliminar sobre la incidencia de bocio endémico en Nicaragua. Bol. Sanit. Nicaragua. Edición especial dedicada a labores del INCAP en Nicaragua. Managua, julio 1956, pp. 52–58.

(54) Arce Paiz, A.: Encuesta sobre bocio endémico en 7,357 escolares de Nicaragua y medidas prácticas para su prevención. Bol. Sanit. Nicaragua 2: 300–305 (1956).

(55) Reverte C., J. M.: Bocio endémico en Panamá; un problema nacional. Panamá, Imprenta Nacional, 1958.

(56) Reverte C., J. M.: Bocio endémico en la provincia de Herrera (Contribución a su estudio). Arch. méd. paname. 3: 121–137 (1954).

(57) Reverte C., J. M.: Bocio en la infancia y sus consecuencias. Arch. méd. paname. 4: 9–17 (1955).

(58) Reverte C., J. M.: Bocio endémico en el Distrito de Chame (Panamá); Contribución a su estudio. Arch. méd. paname. 4: 45–54 (1955).

(59) Reverte C., J. M.: Prevención del bocio endémico. Arch. méd. paname. 4: 100–110 (1955).

(60) Peña, R., and Isasi Fleitas, D.: El problema del bocio endémico y su profilaxis en el Paraguay. Bol. Ofic. san. panam. 25: 1090–1096 (1946).

(61) Servicio Cooperativo Interamericano de Salud Pública: La frecuencia del bocio en el Paraguay con recomendaciones para su prevención. An. Fac. cien. med., Asunción 5: 31–52 (1945).

(62) Burga Hurtado, B.: El bocio endémico o coto y su profilaxis en el Departamento de Amazonas. Rev. med. Lima 24: 967–970, 972, 986 (1938).

(63) Salazar N., S. T.: Bocio endémico en el Perú. Lima, Perú, 1952, pp. 1–143.

(64) Burga Hurtado, B.: Nueva contribución al estudio del bocio endémico en el Perú. Rev. per. de Salud Pública 5: 341–354 (1956).

(65) Burga Hurtado, B.: Contribución al estudio del bocio endémico y su profilaxis en el Perú. Rev. de San. de Policía (Lima), Perú 15: 336–444 (1955).

(66) Bauza, J. A., Cerviño, J. M., Salveraglio, F. J.: Epidemiología del bocio endémico en el Uruguay. Bol. Ofic. san. panam. 43: 42–48 (1957).

(67) Bengoa, J. M.: Medicina social en el medio venezolano. 2a. ed. Caracas, 1946, pp. 109–123.

(68) Roche, M., De Venanzi, F., Vera, J., Coll, E., Spinetti-Berti, M., Méndez-Martínez, J., Gerardi, A., Forero, J.: Endemic goiter in Venezuela studied with I^{131}. J. Clin. Endocrinol. 17: 99–110 (1957).

Bitot's Spots and Vitamin A Deficiency

WILLIAM J. DARBY, Ph.D., M.D., WILLIAM J. McGANITY, M.D., D. S. McLAREN, M.D., Ph.D., DAVID PATON, M.D., ATO ZAMED ALEMU, and ATO MAKONNEN GEBRE MEDHEN

Nearly 100 years have elapsed since the French physician, Bitot, described the conjunctival spots which now bear his name. There has since developed a popular concept that these eye lesions are a specific mark of vitamin A deficiency, and despite previously published evidence to the contrary, that idea often appears today. Bitot's spots are such easily recognized lesions that nutrition surveys may conveniently record their presence in large population studies. It is, therefore, important to appreciate the limitations of this conjunctival sign.

Part of the text of this paper is a synopsis of material submitted for publication elsewhere (*1*); some additional data obtained by McLaren in Tanganyika are also included. We have tried to present as briefly as possible the controversial status of Bitot's spots—particularly as this pertains to the interpretation of results of nutrition surveys.

Bitot's spots are grossly visible, discrete, and generally bilateral conjunctival changes—usually located temporally near the corneal limbus (see illustration). When large, they are typically triangular in shape, the apex pointing toward the outer canthus, although they exhibit considerable variation in size and configuration. Due to their foamy substance Bitot's spots have a characteristic refractile silvery-gray hue. If the foamy consistency is not pronounced they may appear as lusterless, finely striated plaques.

Occasionally individuals who do not show Bitot's spots may present identical material smeared along the lid margin or heaped at the outer canthus. Pinguecula, a lesion with a predilection for the same site on the bulbar conjunctiva as that of Bitot's spots, is a more common finding in any population and of no value as an indicator of nutritional deficiency. This lesion is yellowish or partially pigmented, and though elevated its substance lies beneath the epithelium. Moreover, it is less well demarcated and more solid in appearance than Bitot's spots and frequently occurs both nasally and temporally.

Neither pingueculae nor Bitot's spots produce symptoms, and in themselves they require no treatment. Pingueculae are found most commonly in adults, but in populations subject to exposure, they may occur with increased frequency in younger age groups. Bitot's spots

Dr. Darby is professor and chairman of the biochemistry department, Vanderbilt University School of Medicine, Nashville, Tenn. Dr. McGanity is professor and chairman of the department of obstetrics and gynecology, University of Texas Medical Branch, Galveston. Dr. McLaren is medical research officer of the East African Institute for Medical Research, East Africa High Commission, P.O. Box 162, Mwanza, Tanganyika, East Africa. Dr. Paton is at the Wilmer Eye Institute, Baltimore, Md. Ato Zamed Alemu is health officer, and Ato Makonnen Gebre Medhen is with the Ministry of Health and the Pasteur Institute, Addis Ababa, Ethiopia.

are most often found in school-age children, with boys being more frequently affected than girls.

Bitot's spots rarely occur in well-fed populations but, instead, are customarily observed in areas where diet is restricted. They are not peculiar to the pigmented races. The possible etiological influences of race, hygiene, and climate are not easily appraised. Poor nutrition is a factor to be considered, but there is no single striking deficiency which consistently has been demonstrated to be a requisite for the appearance of Bitot's spots.

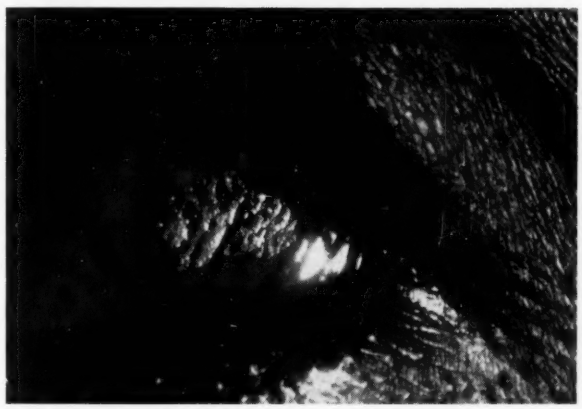
What is the evidence that Bitot's spots may be related to a lack of dietary vitamin A? Historically, the first suggestion comes from Bitot's description of these lesions in children with night blindness (*2*). Experimental studies since his time have specifically linked vitamin A deficiency to reversible night blindness. Impairment of night vision has not, however, been consistently related to Bitot's spots. Disappearance of the conjunctival spots with nutritional improvement and sometimes with vitamin A therapy alone has been reported (*3–7*). There is a single report of Bitot's spots occurring in experimental animals whose major deficiency was intended to be vitamin A (*8*).

On the other hand, experiments in human vitamin A deprivation have failed to produce these lesions (*9*), and there are several studies in which vitamin A administration or foods containing vitamin A failed to abolish Bitot's spots (*10–15*). In this group of publications night blindness was not presented as a characteristic accompaniment of the Bitot's spots, whereas most reports of favorable response to vitamin A have noted impaired night vision as a pretreatment condition.

Recently a mass survey of inhabitants of Ruanda-Urundi was performed for the appraisal of vitamin A deficiency as evidenced by Bitot's spots (*16*). Night vision was not tested. Although there was no correlation of blood levels of vitamin A with the presence or absence of Bitot's spots in individuals, there was a slightly lower average blood level of the vitamin for the total number of persons affected with the spots. Indeed, the observed levels of serum vitamin A were above those usually regarded as associated with clinically recognized deficiency states. Rather than proving a specific Bitot's spots-vitamin A correlation, the results might better be interpreted as indicative of a lower nutritional status in the group with conjunctival spots.

Histologically, Bitot's spots consist of masses of corynebacteria, keratinized epithelial cells, fatty debris, and edema of the mucosa and submucosa. None of these characteristics is pathologically specific for vitamin A deficiency. Bitot's spots contain no unique tissue characteristics. They are localized areas of xerosis whose appearance probably depends upon accumulation of bacteria on a site of bulbar conjunctiva which is relatively protected from lid massage.

Two terms traditionally associated with hypovitaminosis A are xerosis and keratomalacia. Full discussion of these terms extends beyond the scope of this paper, but their importance in regard to the significance of Bitot's spots warrants some mention.



Typical Bitot's spot, a conjunctival lesion located temporally near the corneal limbus

There is no satisfactory agreement as to how xerosis should be defined. Pathologically, it is a keratinizing metaplasia of the epithelium (*17*). Clinically, this gives the conjunctiva a dry, wrinkled, cadaverous appearance. The eyes of healthy persons who are subjected to prolonged outdoor exposure, such as sailors or farmers, may also attain the dry-eyed appearance with fine wrinkling of the bulbar conjunctiva. Such xerosis, or perhaps psuedoxerosis, does not attain the same severity, but it is also a

keratinization. These nutritionally normal people do not have Bitot's spots.

Conjunctival scrapings for the study of keratinized cells have not proved useful in detecting early changes from vitamin A deficiency, for the normal range in amount of keratinization is too great (*18*). Therefore, conjunctival xerosis as recorded in surveys should be regarded as a stage of keratinization which has become clinically manifest. From experimental work on hypovitaminosis, it is clear that this change in the epithelium can result from avitaminosis A, but to consider all clinical xerosis indicative of vitamin A deficiency would be incorrect. In contradistinction, keratomalacia, which is a rapid swelling and necrosis of the cornea found almost exclusively in infants, is a more specific evidence of vitamin A deficiency. Timely administration of vitamin A may produce a gratifying response.

Our own recent observations in Ethiopia and Tanganyika corroborate previous reports which have failed to show a correlation between vitamin A deficiency and Bitot's spots.

Ethiopia

Seventeen hundred and ninety school children in Addis Ababa, Ethiopia, were examined for Bitot's spots in March 1959. Fifty-one were found to have the lesions, an incidence of 3.3 percent among the boys and 1.8 percent among the girls. The ages of the children examined varied over a wide range with an average of 12.3 years, about the same as the average age of those having Bitot's spots. Although the diet of these children was inadequate in several respects, general physical examinations performed on all those with Bitot's spots and a random sample of those without did not show gross

Table 1. Serum vitamin A and carotene levels in school children with and without Bitot's spots, four examinations, Ethiopia, 1958–59

Test item	Children with Bitot's spots				Children without Bitot's spots			
	School 1	School 2	School 3	Total	School 1	School 2	School 3	Total
September 1958								
Number of children	3	2	----	5	28	11	12	51
Mean serum vitamin A (mcg./100 ml.)	20. 3	23. 4	----	21. 5	23. 8	20. 2	25. 8	23. 4
Mean serum carotene (mcg./100 ml.)	123. 9	111. 3	----	118. 9	129. 8	103. 4	152. 3	129. 4
November 1958								
Number of children	16	11	8	35	27	16	12	55
Mean serum vitamin A (mcg./100 ml.)	24. 0	22. 8	28. 5	24. 7	23. 4	29. 0	25. 7	25. 5
Mean serum carotene (mcg./100 ml.)	151. 4	115. 6	171. 4	144. 7	129. 2	115. 7	147. 3	129. 2
March 1959								
Number of children	12	12	8	32	27	10	8	45
Mean serum vitamin A (mcg./100 ml.)	13. 4	22. 3	25. 0	19. 6	14. 3	12. 9	22. 8	15. 5
Mean serum carotene (mcg./100 ml.)	125. 9	154. 0	184. 0	150. 9	154. 9	179. 1	150. 4	159. 5
June 1959								
Number of children	19	8	6	33	18	34	12	64
Mean serum vitamin A (mcg./100 ml.)	19. 4	25. 5	20. 7	20. 9	20. 6	28. 4	18. 7	25. 7
Mean serum carotene (mcg./100 ml.)	121. 8	92. 0	115. 4	113. 4	117. 0	121. 9	132. 0	122. 4

NOTE: School 1 children received skim milk and vitamin C; school 2 children, skim milk and vitamin A; school 3 children received no dietary supplements.

ERRATUM

This erratum is for the purpose of correcting the figures for mean serum vitamin A contained in Table 1, page 740.

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Test item	Children with Bitot's spots				Children without Bitot's spots			
	School 1	School 2	School 3	Total	School 1	School 2	School 3	Total
September 1958								
Number of children	3	2	----	5	28	11	12	51
Mean serum vitamin A (mcg./100 ml.)	36. 1	41. 6	----	38. 3	42. 3	35. 9	45. 9	41. 7
Mean serum carotene (mcg./100 ml.)	123. 9	111. 3	----	118. 9	129. 8	103. 4	152. 3	129. 4
November 1958								
Number of children	16	11	8	35	27	16	12	55
Mean serum vitamin A (mcg./100 ml.)	42. 7	40. 6	50. 7	44. 0	41. 7	51. 0	45. 7	45. 3
Mean serum carotene (mcg./100 ml.)	151. 4	115. 6	171. 4	144. 7	129. 2	115. 7	147. 3	129. 2
March 1959								
Number of children	12	12	8	32	27	10	8	45
Mean serum vitamin A (mcg./100 ml.)	23. 9	39. 6	44. 4	34. 9	25. 4	22. 9	40. 5	27. 5
Mean serum carotene (mcg./100 ml.)	125. 9	154. 0	184. 0	150. 9	154. 9	179. 1	150. 4	159. 5
June 1959								
Number of children	19	8	6	33	18	34	12	64
Mean serum vitamin A (mcg./100 ml.)	34. 6	43. 3	36. 9	37. 1	36. 6	50. 6	33. 2	43. 5
Mean serum carotene (mcg./100 ml.)	121. 8	92. 0	115. 4	113. 4	117. 0	121. 9	132. 0	122. 4

NOTE: School 1 children received skim milk and vitamin C; school 2 children, skim milk and vitamin A; school 3 children received no dietary supplements.

signs of specific deficiency disease. Compared with the bulbar conjunctivae of healthy American school children, the conjunctivae of all these Ethiopian children showed alterations, but the estimated severity of xerosis indicated by the degree of conjunctival wrinkling or dryness was not significantly different in the group with Bitot's spots from that in the group without the spots.

Night vision testing, using a modified radium plaque device (American Optical Instrument Co., U.S. Navy specifications), was performed, also in March 1959, on 244 of these Ethiopian children. Of this group, 28 had Bitot's spots and 216 were without the spots. Standards for comparison were obtained by using the same instrument under comparable conditions to test a group of 77 American school children in Bethesda, Md. Based on these standards, no evidence of impaired night vision was found in any of the 244 Ethiopian children tested.

At three schools near Addis Ababa, serum carotene and vitamin A levels were determined on children with and without Bitot's spots in a series of four examinations (*19*). After the first examination children in school 2 (table 1) received supplements of 8,000 I.U. of vitamin A for 5 days per week for 6 weeks, whereas those

Table 2. Observations of Bitot's spots in 10 patients at the Church Missionary Society Leprosarium, Makutapora, Tanganyika, in connection with vitamin A trial, 1959

Patients		Observed state of lesions					
Sex	Age (years)	June 25, 1959	July 17, 1959	August 28, 1959	September 25, 1959	October 22, 1959	January 18, 1960
Female	40	Left lateral material approximately 3x3 mm. no definite shape, scattered foam	----------	No spot	----------	Few small spots again	Few small spots still present
Male [1]	20	Right lateral 6x3 mm. heavy accumulation	ISQ	----------	Very faint now. Left eye now has faint striations	Right eye and left eye ISQ	Large amount of material lateral and bilateral
Female [1]	25	Right lateral patch of foam on a larger white area	ISQ	Much diminished	No further change	Still present	ISQ but only raised, no foam
Male	29	Left lateral dumbbell-like area of material	----------	No spot	----------	Returned and increased	Still larger
Male [1]	8	Right lateral two flecks of foam only	No spots	One small fleck	----------	----------	ISQ
Male [1]	40	Right medial three small areas on pinguecula	Doubtful if present	Definitely present again	----------	ISQ	ISQ
Male [1]	26	Left lateral two definite spots	ISQ	Complete disappearance	----------	----------	Two large spots, no foam
Male [1]	30	Left medial one small spot	----------	Minute	Nothing seen	Spot returned	Left leprosarium
Male	30	Left lateral pinhead spot	----------	Nothing seen	Small spot seen	Small spot, both eyes laterally	ISQ
Male	40	Left lateral appreciable size	ISQ	Left leprosarium	----------	----------	----------

[1] Patients receiving vitamin A therapy.
ISQ=In status quo.

Table 3. Percent incidence of Bitot's spots, xerophthalmia, and keratomalacia among children examined in Tanganyika, March 1959

Item	Mvumi		Mwanza	
	Male	Female	Male	Female
School children				
Number examined	670	395	331	114
Percent incidence:				
Bitot's spots	0.4	0.5	1.8	0
Xerophthalmia	0.3	0.2	0	0
Preschool children				
Number examined	232	236	-----	-------
Percent incidence:				
Bitot's spots	0	0	-----	-------
Xerophthalmia	8.2	5.5	-----	-------
Keratomalacia	1.7	0.8	-----	-------

in the other two schools did not. Eight weeks after the second examination supplementation was discontinued. Supplementation was resumed after the third examinations. The distribution of levels of serum vitamin A and carotene in individuals with Bitot's spots followed the same pattern found throughout the country in the initial survey of over 8,000 persons.

This relatively short-term study has failed to reveal any effect on Bitot's spots from vitamin A administration.

Tanganyika

Subsequent to our work in Ethiopia, further observations of Bitot's spots in relation to vitamin A were made on a smaller scale in Tanganyika.

A trial of vitamin A therapy, supervised by Dr. K. R. Dalley, was undertaken with a few patients at the Church Missionary Society Leprosarium at Makutapora in 1959. Ten patients with Bitot's spots were divided into two groups for treatment and observation. During the trial period, June 25–October 14, six patients received 150,000 I.U. of vitamin A twice weekly under the supervision of a European nurse. Four patients received no vitamin A supplement.

The Bitot's spots of patients in both groups were observed several times during the trial and again 3 months after vitamin A therapy had been stopped (table 2). Though the conjunctival lesions varied considerably from one observation period to another (similar variations occurred in the individual Ethiopian school children with Bitot's spots during the 9 months of observation), there was no difference in the pattern of variation in individuals treated with vitamin A as compared with those untreated. Nor did vitamin A blood levels show differences between the two groups. The night vision of seven of the patients showed no impairment.

In Mwanza, Tanganyika, on the shores of Lake Victoria, there is no food shortage. At Mvumi, Tanganyika, in the dry central Province where famine has been frequent, there is dietary deficiency of vitamin A and protein. The occurrence of Bitot's spots among school children in these two areas was 5 cases in 1,065 children examined in Mvumi and 6 cases in 445 children examined in Mwanza—at least as many spots in Mwanza as in the nutritionally less fortunate region (table 3). Among 468 preschool children in Mvumi, keratomalacia had occurred in 6, whereas in Mwanza during 2 years of pediatric, ophthalmic, and nutritional hospital practice, not a single case has been discovered. In Addis Ababa, for another example, keratomalacia is said to be rare. No case was seen during the nutrition survey of Ethiopia in 1958 (*19*). Therefore, keratomalacia, the more specific indicator of vitamin A deficiency, and Bitot's spots are not necessarily associated occurrences.

This conclusion is worthy of emphasis. There need be no correlation between the presence of Bitot's spots and hypovitaminosis A. For this reason, the convenience of recording Bitot's spots in nutritional surveys must not tempt workers into assigning a specific interpretation to these lesions. Like other clinical signs, the nutritional significance of the lesion must be evaluated in conjunction with other evidence.

REFERENCES

(*1*) Paton, D., and McLaren, D. S.: Bitot's spots. Am. J. Ophth. (In press.)

(*2*) Bitot, P.: Sur une lesion conjonctivale non encore

decrite coincidant avec l'hemeralopie. Gaz. hebd. méd. 10: 284–288 (1863).
(3) May, Q. I., and Wolff, E.: A case of xerophthalmia. Lancet 235: 252–253 (1938).
(4) Tupas, A., Pechache, L. V., and Melo, A.: Xerophthalmia and keratomalacia in children. J. Philippine M. A. 23: 137–143 (1947).
(5) Fasal, P.: Clinical manifestations of vitamin deficiencies as observed in the Federated Malay States. Arch. Dermat. & Syph. 50: 160–166 (1944).
(6) Spence, J. C.: A clinical study of nutritional xerophthalmia and night blindness. Arch. Dis. Childhood 6: 17–26 (1931).
(7) McKenzie, A.: Bitot's spots. *In* Letters to the editor. Lancet 237: 341–342 (1939).
(8) Hetler, R. A.: The development of xerophthalmia and the keratinization of epithelial tissue on withdrawal of vitamin A from the diet of the monkey (*Macacus rhesus*), guinea pig, rabbit and adult albino rat. J. Nutrition 8: 75–103 (1934).
(9) Hume, E. M., and Krebs, H. A., compilers: Vitamin A requirement of human adults. An experimental study of vitamin A deprivation in man. Medical Research Council, Great Britain, Special Report Series No. 264. London, 1949.
(10) Metivier, V. M.: Bitot's spots in Trinidad. Am. J. Ophth. 24: 1029–1034 (1941).
(11) Appelmans, M., Lebas, P., and Missotten, L.: A propos de l'avitaminose A et ses manifestations oculaires. Scalpel 110: 217–234 (1957).
(12) Aykroyd, W. R., Rajagopal, K., and Krishnan, B. G.: The state of nutrition of school children in South India. Indian J. M. Res. 24: 419–437, 707–725 (1936).
(13) Berliner, M. L.: Regarding the early detection of avitaminosis A by gross and biomicroscopic examination of the conjunctiva. Am. J. Ophth. 25: 302–308 (1942).
(14) Bouzas, A.: Sur la signification des taches de Bitot. Bull. Soc. opht. France 3: 185–191 (1959).
(15) Rodger, F. C.: Eye disease in African children. Brit. J. Ophth. 42: 336–347 (1958).
(16) Roels, O. A., Debeir, O., and Trout, M.: Vitamin A deficiency in Ruanda-Urundi. Trop. Geogr. Med. 10: 77–92 (1958).
(17) Mason, K. F.: Effects of vitamin A deficiency in human beings. *In* The vitamins. New York, Academic Press, Inc., 1954, vol. 1.
(18) Youmans, J. B., Corlette, M. B., Corlette, M. G., and Frank, H: Inadequacy of conjunctival smears in the diagnosis of slight vitamin A deficiency in adults. J. Lab. & Clin. Med. 23: 663–670 (1938).
(19) Interdepartmental Committee on Nutrition for National Defense. Ethiopia: Nutrition Survey. Bethesda, Md., National Institutes of Health, September 1959.

Guide for Community Psychiatric Clinics

A new 309-page volume issued by the New York State Department of Mental Hygiene under the title "A Guide to Communities in the Establishment and Operation of Psychiatric Clinics" brings together concrete answers to some of the numerous practical questions confronting those who set up and maintain community psychiatric clinics. Emphasis is on proved standards, and attention is given to choice of auspices, problems of cost and equipment, selection of suitable personnel, formulation of policy and handling of administrative issues. Appendix material includes illustrative forms and guides, budgets, fee scales, and the like, as well as copies of the laws, regulations, and official documents which provide the supporting network by means of which some 300 licensed clinics are able to operate currently in New York State.

The guide is based on the extensive clinical and field consultation experience of the authors, Luther E. Woodward, Ph.D., senior mental health representative, and Winifred W. Arrington, M.S.S., mental health representative, in the division of community services of the New York State Department of Mental Hygiene.

The book may be purchased from the Division of Community Services, New York State Department of Mental Hygiene, 240 State Street, Albany, N.Y.

Nutritional Survey of Rural Families in Jequitibá, Brazil, 1957–58

FRANK W. LOWENSTEIN, M.D., D.P.H.

In 1956, I was asked to plan and help organize a nutritional survey in several areas of the State of Minas Gerais, Brazil, in which ACAR was working. The request was made by the directors of ETA. The survey was conducted to find out what the people were eating and to determine their general health and nutritional status as a basis for planning an educational program in nutrition and health to be executed by the ACAR field staff.

After an orientation trip in May 1956 through various regions in which ACAR was working, it was decided to make a pilot survey near Sete Lagoas, 60 kilometers (37½ miles) north of Belo Horizonte and the site of an ACAR office. The following criteria were used in the final selection of the area:

1. It should be readily accessible to researchers operating from a convenient base.

2. It should be a typical work area of ACAR, with families of borrowers and non-borrowers more or less evenly distributed. (The term "borrowers" refers to families receiving both technical and financial assistance from ACAR; "non-borrowers," to those receiving technical but not financial assistance from ACAR.)

3. There should be enough other families of approximately the same economic level in the area who had never been in contact with ACAR to form a kind of control group.

Jequitibá, the county neighboring on Sete Lagoas to the north and east, fulfilled those criteria and was selected as the survey area. Jequitibá lies on both sides of the Rio das Velhas, which flows from southeast to northwest. ACAR technicians from the Sete Lagoas office were working with families living west of the river but with none on the east side.

The average elevation in Jequitibá is between 650 and 750 meters (2,140 to 2,460 feet) above sea level. Most of the area is rugged, hilly country. Soil fertility varies from good to very poor. The climate is generally agreeable, with only small differences in temperature from summer to winter. Rainfall is concentrated from November to April and is much less than in the southern part of the State.

The principal crops are corn, rice, beans, sugarcane, and manioc (cassava). Beef and dairy cattle, hogs, horses, mules, and poultry also are produced. Milk production reaches 2.2 million liters (nearly 2.3 million quarts) per year, most of which goes to the creamery in Sete Lagoas for making butter, cheese, and dried milk. The small amount of home industry consists mainly of primitive installations to grind corn and manioc and to make raw sugar.

More than 80 percent of the 10,390 people in

Dr. Lowenstein is with the nutrition unit of the World Health Organization, Geneva, Switzerland.

the county are dispersed throughout the rural area. The county seat has a church, a club, and a movie theater. There are 21 rural schools in the county, maintained by the county government. Official statistics show that 12.8 percent of the population above the age of 10 is illiterate. Government health services reach the rural dwellers only when they go to health centers in the towns. Federal and State agricultural services give some help to farmers.

Since ACAR works mostly with the small landholder, the pilot survey was limited to this group. These farmers generally have 20 to 50 hectares (49 to 123 acres) of land, and this was adopted as the main criterion for the selection of the 54 families to be studied. For borrowers, accurate information on size of property was available at the ACAR office in Sete Lagoas; for non-borrowers and the control group, the only information available was in the tax collector's office. These records were not always accurate because, for tax reasons, farmers often understated the size of their property. Size of property, however, is not always the best measure for selecting a sample of families of the same economic level, since economic values of land depend on its fertility and the use the owner makes of it. Usage as well as amount of land was considered in selecting an economically homogeneous sample.

Participants

In 1957, 54 families, composed of 419 persons, participated in the survey; in 1958, only 50 families, composed of 344 persons, took part. Four large families had moved or were absent from the county during the second survey. The mean number of persons per family was 7.7.

The 54 families selected for study represent only 26 percent of all property owners in the county, and 49 percent of these are submarginal. They were divided into three groups of 18 families each, as follows:

Group 1. ACAR borrowers: All families in Jequitibá receiving financial as well as technical assistance from ACAR were included.

Group 2. Non-borrowers: Families were chosen from the larger number in the county to which ACAR was providing technical but not financial assistance. They were selected on the basis of their socioeconomic similarity to the borrower families, and the location of their properties in areas similar to those in which the other groups lived.

Group 3. Families having no contact with ACAR and living on the east bank of the river: These were chosen by lot after eliminating all families living on farms of 20 to 50 hectares which were difficult to reach or were very dissimilar to the farms in the other two groups.

Before starting collection of the data, each of the three doctors on the survey team examined the same 20 boys in an orphanage in Belo Horizonte and compared their findings in order to determine individual variations in grading and to obtain close agreement on diagnostic criteria. This assured a high degree of uniformity in the clinical examinations. All three physicians had previous training in clinical nutrition. Since the women on the team had worked as home economists of ACAR for 1 year or more, they were reasonably well prepared for their part in the survey. Before starting the collection of the data, the members of the team were given detailed instructions on the techniques to be used.

The survey team began collecting the following data in July 1957:

Definitions

The Associação de Crédito e Assistência Rural (ACAR) is an extension organization which began work in 1949, using supervised credit as one of the tools in its rural development program. It was founded jointly by the Minas Gerais State Government and the American International Association for Economic and Social Development (AIA), a Nelson Rockefeller nonprofit entity. At the end of 1958, ACAR had more than 60 local offices in the rural areas of Minas Gerais, each office being staffed by a farm supervisor and a home economist.

Escritório Técnico de Agricultura Brasil-Estados Unidos (ETA) is a joint project of the U.S. Government's point 4 organization and the Brazilian Ministry of Agriculture, working in many fields of agricultural improvement in Brazil. It has participated in ACAR since 1955, making major contributions in both funds and technical assistance.

Table 1. Age and sex distribution of persons examined by a physician by study group,[1] 54 families in Jequitibá, Brazil, 1957 and 1958

Age group (in years)	Group 1				Group 2				Group 3			
	Male		Female		Male		Female		Male		Female	
	1957	1958	1957	1958	1957	1958	1957	1958	1957	1958	1957	1958
Less than 1	3	0	0	0	1	0	0	0	0	0	0	0
1–4	4	5	9	8	15	11	7	7	11	8	4	4
5–9	10	7	12	8	17	12	9	9	15	11	10	9
10–14	5	5	7	9	10	9	11	8	10	8	8	4
15–19	8	7	8	6	6	4	12	7	4	1	10	6
20–29	11	11	9	8	1	0	5	7	3	3	14	12
30–39	5	6	7	6	4	5	7	6	4	3	3	2
40–49	8	7	4	3	7	6	4	3	4	3	7	7
50–59	2	2	4	4	3	1	2	2	4	3	2	2
60 or over	4	2	2	2	1	1	2	1	0	0	0	0
Total	60	52	62	54	65	49	59	50	55	40	58	46

[1] Group 1, borrowers from ACAR; group 2, non-borrowers; group 3, no contact with ACAR.

1. Reports on general socioeconomic conditions of the families, including conditions in the homes, were collected by the home economists on their visits.

2. Information on habits, superstitions, and food taboos were recorded by the home economists.

Seven-day food-consumption records of the families were kept daily by the housewife after instruction was given by the home economist, who later checked the records when she visited the family. (On the average, three visits were made during the week of the survey.)

4. Individual food intake was recorded during 3 weekdays. These records were checked on the first day by the home economist who weighed and measured individual portions of food and recorded the data on individual forms. On the other 2 days either the housewife or another responsible person did the weighing, measuring, and recording.

5. Data on the nutritional and health status of each individual were collected by the physician during an inspection of the home and recorded on a special form. Clinical examinations were supplemented by laboratory examinations of blood and fecal specimens. The hemoglobin was measured in blood specimens of all children aged 2 to 16 years by a laboratory technician who went to the home. Fecal samples were collected in the homes and brought to the State public health center in Sete Lagoas, where they were examined for parasites.

Reports of the examinations were sent to Servico Especial de Saúde Pública, a Brazilian-American governmental agency working in public health in Rio de Janeiro, where they were tabulated in accordance with detailed instructions.

To determine whether some of the clinical findings were due to seasonal variations in the diet of these families, early in March 1958, 8 months after the first survey, a followup survey was made of the same families visited in July 1957. Data collected during the second survey consisted of 7-day food-consumption records and results of a second clinical examination in the homes, including laboratory tests for hemoglobin and parasites in the stool. These data

Table 2. Income and expenses, in cruzeiros, of 54 families in Jequitibá, Brazil, 1956

Income and expenses	Group 1	Group 2	Group 3
Median annual income	46, 393	34, 500	26, 800
Total expenses	15, 845	24, 470	11, 670
Home and fuel	2, 775	5, 370	1, 450
Food	6, 250	13, 100	6, 170
Medical care, including drugs	2, 000	1, 500	1, 050
Other	4, 820	4, 500	3, 000

were treated in the same way as those from the first survey, and a comparison was made between the two.

Table 1 shows for both surveys the age and sex distribution of persons in the three study groups who were examined by a physician. The age distribution for females was similar in the three groups, but there were considerably more males between 1 and 14 years of age in groups 2 and 3 than in group 1.

The distribution by color was similar in the three groups, with a slight preponderance of the white color over the mixed color (pardo) among the males of groups 1 and 2 and among the females of group 3. There were only nine individuals of true black color (two males and seven females).

About two-thirds of all the families had lost between one and five children through illness. More than one-fourth (27.1 percent) of all persons examined had already lost either father or mother or both.

More than three-fourths (78.7 percent) of all persons above the age of 6 were able to read and write, with group 1 showing the highest number. However, 9 percent did not give information on literacy.

The great majority of the men were farmers, and most of the women were housewives. Group 1 had the highest median income per family and group 3 had the lowest, whereas the total median expenses per family were highest in group 2. Table 2 shows median incomes and expenses per family in the three groups for 1956, given in cruzeiros, the Brazilian currency. At that time 1 U.S. dollar would bring about 70 cruzeiros.

Housing and Sanitation

The majority of the homes of families in groups 1 and 2 are built of bricks, whereas most of the homes of group 3 families are of adobe. The number of rooms varies from 4 to 19, with the median between 9 and 10 (usually 3 sleeping quarters) in all three groups. This seemingly high median should not be taken to indicate that the houses are comparable to 9- or 10-room homes in more developed parts of the world. Usually the rooms are small, sparsely furnished, and far from luxurious. The conditions of the home, kitchen, and stove are presented in table 3.

Table 3. Conditions of home and kitchen of 54 families in Jequitibá, Brazil, 1957–58

Unit	Percent		
	Good	Fair	Poor
Home in general (all groups)	20. 4	55. 6	24. 0
Kitchen (all groups)	5. 6	57. 4	37. 0
Stove (kitchen):			
Group 1	33. 3	44. 4	22. 3
Group 2	16. 7	50. 0	33. 3
Group 3	11. 1	38. 9	50. 0

A kitchen classified as "good" had: floor made of tiles, wood, or cement; clean, well-kept walls; closed cupboards for utensils, dishes, and food; adequate equipment for preparing and serving food; at least one window; an appropriate table or space to work; jars with tops for storage of staples (sugar, floor, coffee, beans, rice); and a stove with a chimney and oven. One described as "fair" was in passable but not in good condition, or lacked one of the listed items. A kitchen classified as "poor" was in generally bad condition, or lacked two or more of the listed items.

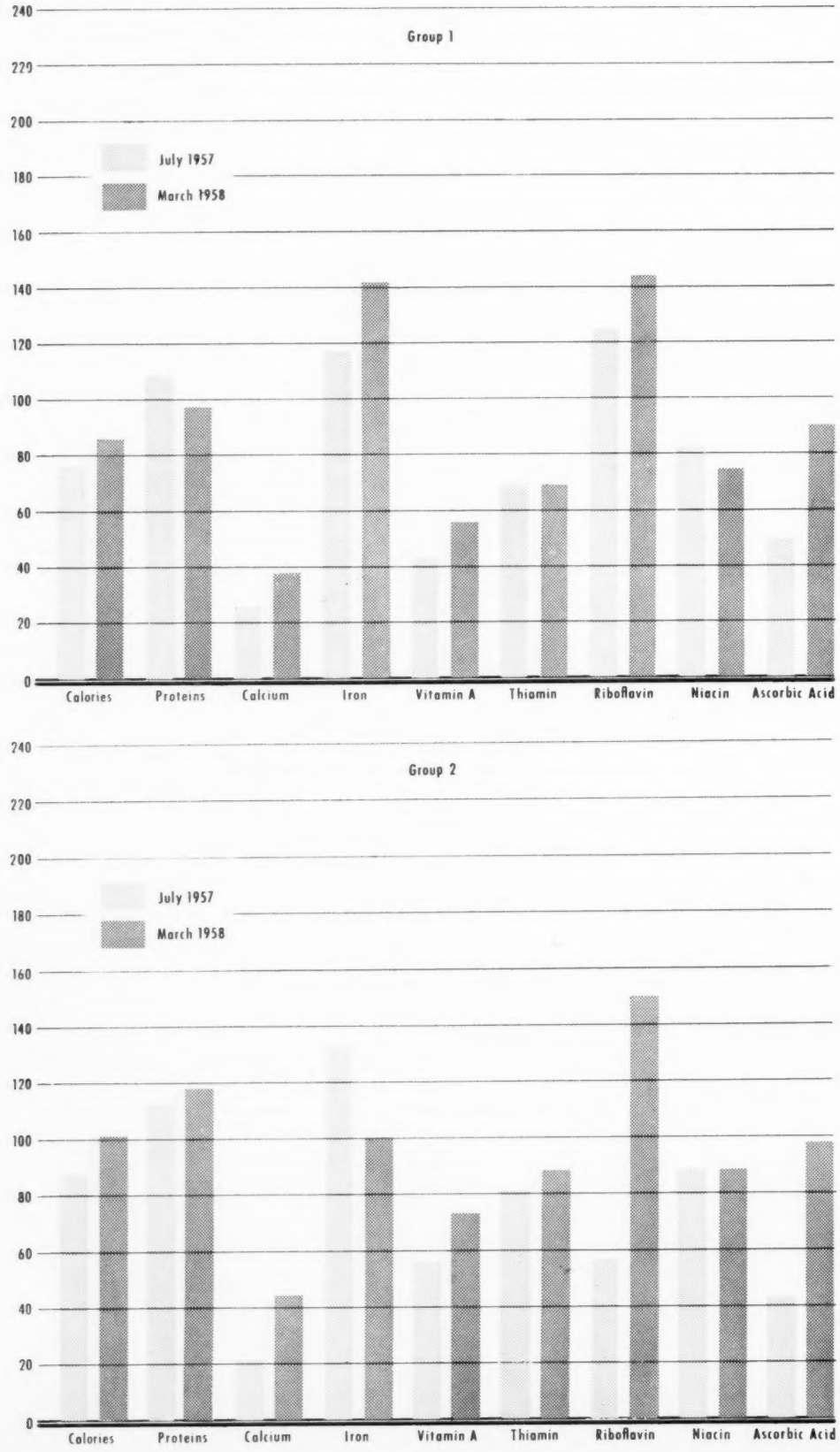
A stove called "good" was well kept, functioning well, with chimney and oven. A "fair" stove was in passable but not good condition, with either chimney or oven lacking. A "poor" stove lacked more than one item.

Sanitary conditions in the majority of homes were basically poor. The source of water for 63 percent of the families was a shallow creek; for 27.8 percent, a well; and for 9.2 percent, a spring. Water filters were used by 55.6 percent of the families in group 1, 11.1 percent of those in group 2, and 16.7 percent in group 3. Water samples were collected from 12 sources of supply and analyzed for fluorine content at the laboratory for water analysis of the State of Minas Gerais. All samples were distilled and then examined by standard methods. The fluoride content per 1,000 liters of water ranged from 0 to 0.7.

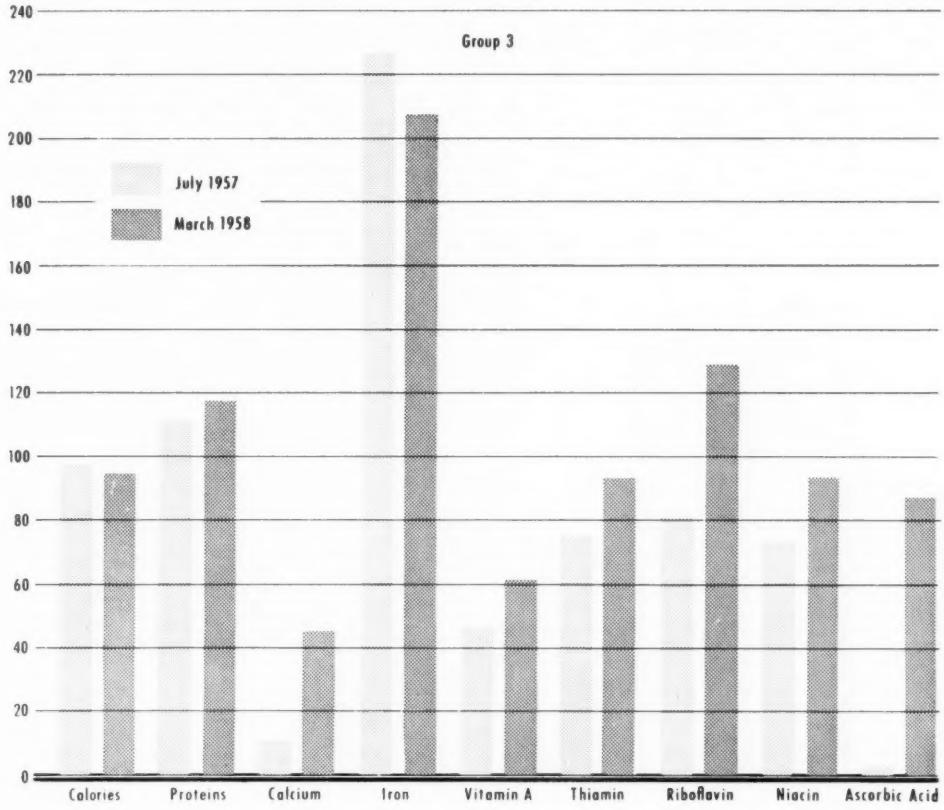
Only 38.9 percent of the families in group 1 and 16.7 of those in group 2 had privies; there were none in group 3.

The great majority of the homes in all three groups were without running water, electricity,

Percentage of mean nutritive values consumed by 54 families in Jequitibá, Brazil,



in relation to "normal" requirements for two seasons, July 1957 and March 1958



and radio, but did have sewing machines. More than 50 percent of the homes in groups 1 and 2 had a storeroom for food supplies whereas only 17 percent in group 3 had such rooms.

Food Economics

Expenditures for food were highest in group 2, while medical expenditures were highest in group 1 (table 2). In groups 1 and 3 the lowest earners spent a significantly higher percentage of their income for food than the highest earners. In group 2 these differences were less pronounced (table 4).

Table 4. Percentage of annual income spent for food by 54 families in Jequitibá, Brazil, 1956

Income group (cruzeiros)	Group 1	Group 2	Group 3
5,000–17,500	45. 7	25. 1	51. 8
18,000–45,000	12. 6	48. 0	58. 7
46,000–70,000	20. 0	57. 3	22. 0
71,000–220,000	7. 7	13. 7	7. 7

In order to see how the housewives spent their food cruzeiros, the investigators asked them to record the price of each item bought. About 20 percent of the daily food bill was spent for fats and oils (except butter), 12 percent for sugar, between 12 and 20 percent for meat, and between 10 and 12 percent for coffee. For all other items, they spent less than 10 percent.

All families raised some animals for food; most of them had chickens, pigs, and a few cows. Few families supplemented their meat supply through hunting, although some did fish (61 percent in group 2).

In July, the dry season, when the first survey was made, no family was without a vegetable garden, but most gardens contained only a few varieties, such as lettuce, onions, parsley, tomatoes, collards, and garlic, generally in small amounts. More families in group 1 planted these vegetables than in groups 2 and 3. Only a few families planted such vegetables as yellow squash, carrots, sweet peppers, and soybeans. The picture changed in March at the end of the rainy season, when there were

more vegetables and more varieties. Fruits grew in all yards, though only a few varieties. Almost all families had orange trees, some had banana plants, and only a few had guava, papaya, and avocado trees, with more families in group 1 having the last three.

Food Habits and Taboos

In their preference for specific foods, all three groups showed much uniformity, although more families in group 1 gave vegetables and eggs as their preferred foods than in the other two groups. Percentages of all 54 families preferring specific foods follow:

	Percent
Beef	87.0
Rice	72.2
Macaroni	59.3
Beans (dried)	59.2
Vegetables in general	35.2
Eggs	29.6
White potatoes	27.7

Chicken was considered Sunday fare by 77.7 percent of the 54 families; macaroni, by 42.5 percent; and sweet desserts, by 26.7 percent. Families in group 2 showed a higher preference for macaroni on Sundays and holidays than those in the other two groups. Whereas four families in group 1 used the same type of food on Sundays as on weekdays, only one family in group 2 and one in group 3 did so. Leftovers were used by the great majority of the families either for supper or for feeding animals. Most families considered protein foods and vegetables of greater nutritional value than starchy foods (table 5).

There were some differences among groups in describing the "nature of food." For example, none of the families in group 3 called collards "hot"; only three families, 16.7 percent, in group 1 called pork "hot"; strawberries were called "hot" by 27.8 percent of the families in group 1 only. Rice was called "cold" by only 22.2 percent of the families in group 3. One third of the families in group 1 called manioc meal "cold." Only 11 percent of the families in group 2 called tomatoes "cold." The terms "hot" and "cold" are unexplainable since they do not refer to seasoning nor to temperature. More families in group 3 than in the other two groups, 83.3 percent, called black

Table 5. Nutritional evaluation of foods by 54 families of Jequitibá, Brazil, 1957

Food	Percent of families that consider food—	
	Of nutritional value	Without nutritional value
Beef	46.3	0
Beans (dried)	38.9	3.7
Eggs	38.9	0
Vegetables in general	37.1	0
Milk	27.8	0
White potatoes	24.1	0
Rice	9.3	61.1
Macaroni	11.1	24.1
Manioc meal	2.0	18.5

beans "heavy," but only 11.2 percent called eggs "heavy." Yellow squash was considered a "food of the poor" by three times as many families in group 1 as in group 3. Rice was considered a "food of the rich" by 38.9 percent of the families in group 3, but by none in the other groups. Macaroni was called a "food of the rich" by 50 percent of the families in group 2. Table 6 shows how the families in all three groups ranked food by this folk designation.

The following food taboos were observed by the families:

Taboos	*Percent of 54 families*
Did not take milk with fruits	59.3
Did not change diet during influenza illness	62.9
Did not take fruits during fever	48.2

Considerably fewer families in group 1 than in groups 2 and 3 did not change their diet when they had the "flu" (44.4 percent compared with 72.7 percent), whereas more families in group 1 did not eat fruits during fever.

Mothers in the 54 families abstained from certain foods immediately after parturition as follows:

Postnatal taboos	*Percent of mothers*
Did not eat fruits	74.1
Did not eat meat	29.6
Did not eat eggs	79.6
Did not drink milk	59.3

In group 2, 50 percent of the mothers did not eat fruit during the postnatal period, while in

group 3 the figure was 94 percent. In group 1, 50 percent ate no meat during that period, except chicken. Group 3 showed the highest percentage, 83.3 percent, of those who did not drink milk at that time, and group 2 the lowest percentage.

Foods desired during the postnatal period by mothers in the 54 families are listed in order of preference.

Food preferred (not actual consumption)	*Percent of mothers*
Chicken	83.2
Rice	46.3
Beans (dried)	38.6
Pork	35.5
Macaroni	29.6

Rice was preferred by almost twice as many women in group 3 who had just given birth as in group 1; dried beans were preferred by fewer mothers in group 2 than in the other two groups.

Food Consumption

Data on daily food consumption were obtained for 53 of the 54 families in the survey in July 1957 and for 49 of the 50 families surveyed in March 1958. Individual diet records were checked in July 1957 by weighing cooked portions of food for 1 day.

Seven-Day Family Diet Record

In 1957 there were significant differences in food consumption, based on the t test at the 5 percent level, in the three groups in their consumption of white wheat bread, fresh beef, milk (liquid), yellow squash, Irish potatoes, white wheat flour, refined sugar, and raw sugar (table 7). Similar differences, found during the second survey in March 1958, represent part of the food pattern of the families in the three groups. The differences in the consumption of inhame, bananas, oranges, papayas, and condiments, apparent in July 1957, disappeared largely in 1958.

Differences within the same group during the two seasons varied from group to group for such items as milk, tomatoes, guavas, and Persian limes. They may reach significance in one group, but show little in another. Table 8 shows the mean nutritive value per unit of nutrition (*1*) corresponding to the total consumption during the two seasons.

The graphs show the percentage of the National Research Council allowances (*2*) in comparison with the nutritional intakes given in table 8. These graphs clearly reflect the influence of seasonal differences on the nutrition of these families.

Three-Day Individual Diet Record

The individual diet records checked by weighing cooked portions of food for 1 day in July 1957 showed good agreement with the 7-day family records for the B vitamins in all three groups, for calories in groups 1 and 3,

Table 6. Designation of nature of foods by 54 families of Jequitibá, Brazil, 1957

Food	Percent of families that described food as—					
	Hot	Cold	Heavy	Light	Of the poor	Of the rich
Pork	33.3	0	0	0	0	0
Leaf cabbage	16.7	5.6	11.1	1.7	7.4	1.7
Peanuts	29.6	0	0	0	0	0
Yellow squash	16.7	1.7	1.7	3.7	22.2	1.7
Okra	20.4	0	0	0	9.3	1.7
Lettuce	0	72.1	0	7.4	1.7	1.7
Rice	0	40.7	7.4	33.4	70.6	20.4
Manioc meal	0	16.7	5.1	0	11.1	0
Tomatoes	0	22.2	0	3.7	1.7	1.7
Macaroni	0	7.4	3.7	16.7	12.9	31.5
Black beans	11.1	0	64.8	1.7	87.0	5.6
Eggs	3.7	0	27.8	0	7.4	9.3
White potatoes	0	9.3	0	9.3	1.7	16.7
Milk	0	17	0	37.1	1.7	7.4
Corn meal mush	0	1.7	0	46.3	3.7	0
Vegetables in general	0	0	0	5.6	22.2	11.1
Beef	1.7	0	11.4	1.7	11.4	64.8

and for proteins in groups 2 and 3. They differed considerably in the values for calcium, iron, and particularly vitamin C, which showed values from 2 (in group 1) to 30 times (in group 3) as high in the individual diet records. This is explained by the amounts of oranges, Persian limes, and bananas recorded on the individual 3-day form, which in group 3 exceeded the amounts registered on the 7-day family record by as much as nine times for oranges and three times for bananas. This brings out a serious error in family records based on the information that the housewife puts down daily by recall only. The error occurs most frequently in recording the fruits that are eaten between meals, particularly by children, often away from home, thus escaping the mother's attention. The differences found were usually

Table 7. Mean daily consumption of food per family in grams for 54 families in Jequitibá, Brazil, during two seasons, July 1957 and March 1958

Food	Group 1		Group 2		Group 3	
	July 1957	March 1958 [1]	July 1957	March 1958 [1]	July 1957	March 1958 [1]
White wheat bread	[2] 188		[2] 143		[2] 21	
Fresh beef	[2] 226		107		[2] 82	
Milk (liquid)	[2] 1, 143	1, 367	779	1, 083	[2] 376	[2] 1, 081
Lettuce	[2] 38	0	[2] 103	0	64	0
Yellow squash	[2] 60	[2] 157	[2] 111	[2] 253	[2] 36	[2] 115
Irish potatoes	[2] 115		[2] 136		[2] 23	
Inhame (a tuber)	17		89		50	
Bananas	[2] 7	[2] 295	[2] 85	[2] 236	[2] 24	[2] 193
Oranges	[2] 143	[2] 583	[2] 99	[2] 322	[2] 70	[2] 601
Papaya	93		20		48	
White wheat flour	[2] 36		[2] 140		91	
Condiments	57		5		14	
Refined sugar	[2] 369		[2] 345		[2] 138	
Raw sugar	[2] 88		[2] 124		[2] 523	
Okra	[2] 45	[2] 230	[2] 43	[2] 204	[2] 30	[2] 282
Tomatoes	9	7	39	18	24	7
Araticum	0	45	0	76	0	34
Lemons	1	18	1	24	2	13
Guava	0	126	0	192	0	38
Persian limes	0	45	0	54	0	3
Green corn	0	39	0	95	0	19
Avocado	0	158	0	83	0	43

[1] Some foods were not listed in 1958 because there was so little difference in the amounts consumed.
[2] Significance tested by the t test at 5 percent level.

Table 8. Mean nutritive values per unit of nutrition in 54 families of Jequitibá, Brazil, for two seasons

Nutritive values	July 1957			March 1958		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Calories	2, 471	2, 793	3, 113	2, 759	3, 221	3, 057
Proteins (g.)	72	73	73. 7	64	77	76
Calcium (mg.)	221	172	129	318	355	367
Iron (mg.)	14	16	26	17	12	25
Vitamin A (I.U.)	2, 221	2, 760	2, 351	2, 813	3, 667	3, 050
Thiamin (mg.)	1. 1	1. 3	1. 2	1. 1	1. 4	1. 5
Riboflavin (mg.)	2. 0	. 9	1. 3	2. 3	2. 4	2. 1
Niacin (mg.)	13. 0	14. 0	12. 0	12. 0	14. 8	15. 0
Ascorbic acid (mg.)	38. 0	33. 0	3. 0	68. 0	74. 0	89. 3

much greater in group 3 than in groups 1 and 2, which may indicate less accuracy on the part of the housewives in group 3.

Physical Examination and Laboratory Tests

The mean heights and weights for the adult males in all three groups are 169.3 ±7.8 cm. (5 ft. 6 in. ±3 in.) and 60 kg. ±9.30 kg. (132 lbs. ±10 lbs.); for the females, 155.0 ±6.3 cm. (5 feet. 1 in. ±2.5 in.) and 51.6 ±9.2 kg. (113.5 lbs. ±20 lbs.). Table 9 shows the results of the physical examination during both surveys for the signs frequently associated with deficiency diseases.

The differences in physical findings between the groups during the first examination were not striking, except for xerosis of the skin, which occurred significantly less often in group 1 than in the other two groups. If one compared, however, the differences within the same group from one season to another, the picture changed. The high incidence of follicular hyperkeratosis and xerosis of the skin dwindled to a very small figure in March 1958. Edema of the tongue and hypertrophy of the filiform papillae also diminished, whereas redness, edema, and bleeding of the periodontium showed a reverse trend, at least in groups 1 and 2. The possible causes for these changes will be discussed later.

The hemoglobin determinations on the blood in children aged 2 to 16 years showed that 45 percent had below 12 grams in July 1957, but only 26.9 percent were below that level in March 1958. Fewer than 10 percent had less than 10 grams in July 1957, and an even lower percentage were below 10 percent in March 1958. A new Sahli hemoglobinometer was used in the homes of the subjects for determining hemoglobin in fingertip blood.

Neck examination revealed a high incidence of endemic goiter in all three groups, with an average of 51.8 percent affected in 1957 and

Table 9. Percentage of persons from 54 families of Jequitibá, Brazil, showing signs of deficiency diseases at examination

Sign	Group 1		Group 2		Group 3	
	July 1957	March 1958	July 1957	March 1958	July 1957	March 1958
Paleness of mucosae	6.5	1.9	5.6	2.0	8.5	3.5
Skin:						
Follicular hyperkeratosis	39.5	17.5	43.5	5.9	35.1	8.1
Xerosis	[1] 32.6	4.7	[1] 50.8	2.0	52.1	2.3
Eyes:						
Thickening of conjunctiva	36.8	48.1	24.2	36.6	29.1	26.7
Spots on the conjunctiva	4.1	9.5	1.6	7.3	0	5.8
Circumcorneal congestion	45.9	68.9	52.4	68.3	36.8	52.3
Tongue:						
Edema	14.8	2.8	15.3	2.0	19.7	5.8
Fissures	14.8	9.5	7.3	8.9	12.8	17.4
Filiform papillae:						
Atrophy	9.0	1.9	2.4	4.0	4.3	2.3
Hypertrophy	34.0	15.2	24.2	10.9	21.3	8.1
Fungiform papillae:						
Atrophy	8.2	1.9	3.2	1.0	1.7	1.2
Hypertrophy	4.9	11.4	3.2	4.0	7.7	5.8
Teeth:						
Missing	50.0	47.2	35.5	32.7	37.6	31.4
Carious	50.0	58.5	65.3	68.4	60.0	62.8
Periodontium:						
Redness	4.1	21.7	6.5	13.9	10.3	7.0
Edema	3.3	30.2	5.6	18.8	17.1	7.0
Bleeding	1.6	10.4	4.8	6.9	5.1	8.1
Recession	22.1	17.9	15.3	7.9	18.8	9.3
Extremities:						
Curved legs	13.1	21.7	8.1	13.9	12.8	15.1
Increased calf tenderness	4.9	9.5	.8	6.9	8.5	12.4

[1] Differences significant at 5 percent level (X^2 test used).

56.6 percent in 1958. The majority of the goiters were small grade 1 Kimball classification (*3*). However, a few very large grade 3 goiters were seen in adults, and two cases of cretinism were found. Females showed a higher incidence of goiter, particularly after puberty. Four families were goiter free in 1957, but no family was found without goiter in 1958.

Fecal samples were usually examined within 24 hours after collection of specimens at the public health post of the State health department in Sete Lagoas. Each sample was examined by the direct method and by the concentration method according to Faust (*4*). No quantitative determinations on the amount of parasites or egg counts were done. The results of the fecal examinations, done for only 57.3 percent of the persons examined in 1957 and 63 percent of the persons examined in 1958, are presented in table 10.

Group 3 had the lowest incidence of *Giardia lamblia* and *Ascaris lumbricoides* and the highest incidence of *Necator americanus* and *Schistosoma mansonii*. Incidence of *G. lamblia* increased markedly from July 1957 to March 1958, whereas the other parasites did not show such strong difference between seasons except for a decline in the *Ascaris* incidence in groups 1 and 3 and of *Schistosoma* in group 3. These decreases, however, were due to the medical treatment these people had received.

Discussion

The county of Jequitibá where the survey was performed is a fairly typical county in north central Minas Gerais. The sample of 54 marginal farm families may be considered typical for this group; however, one must keep in mind that they represented only 26 percent of all property owners in the county (49 percent being submarginal), and that some bias may have occurred in the selection of some of the families, particularly in group 2, because of the usually underestimated size of their properties as recorded at the tax collector's office. The first impression, gained during the survey on the east side of the Rio das Velhas, that the families there (group 3) were living, in general, on a lower level than those in the other two groups, was confirmed by the result of the survey. Income and expenditures were lower; homes were in poorer condition; no privies and few storerooms were found. Group 1 usually led in such items as good condition of kitchen and stove and the possession of privies, water filters, and vegetable gardens. Here one could see the effect of educational work done by ACAR technicians over several years.

Information gathered on food habits and taboos threw some light on a very important but neglected field: the people's attitudes toward foods, which usually are formed early in life by traditions, customs, and beliefs. It revealed a realistic attitude in the expressed preferences for the foods they ate most.

The scale of nutritional values assigned to the various foods showed realistic understanding, too, in people who had not received any special training in nutrition. The designation of some foods (table 6) as "hot" or "cold" is puzzling, although it is understandable why people should call black beans "heavy" and rice "light," since beans are difficult to digest and the rice is easy. One can also understand why

Table 10. Percentage of persons found to have parasites during examination of members of 54 families in Jequitibá, Brazil

Group	Total examined both periods	Types of parasites							
		Giardia lamblia		*Ascaris lumbricoides*		*Necator americanus*		*Schistosoma mansonii*	
		1957	1958	1957	1958	1957	1958	1957	1958
1	38	18.4	47.4	23.7	10.5	60.6	62.9	0	1.1
2	29	17.2	44.8	37.9	34.5	66.7	62.5	1.5	0
3	19	5.3	15.8	21.1	0	79.7	72.4	26.3	5.3

people classify rice and beans as food "of the poor" and beef as food "of the rich," since beef is much more expensive than rice.

The most important finding in this field, however, was that a large percentage of persons had taboos which were not only unrealistic but might actually have been detrimental, promoting and prolonging ill health. Taboos relating to the postnatal diet may have serious consequences for the health and vigor of the nursing mother as well as the infant. During the postnatal period the mother should eat an abundant variety of protective foods, such as fruits, milk, and eggs; but the women studied restricted their diets tc a few "preferred" items.

These taboos are confined neither to one area nor to one class. I have encountered the same taboos in other parts of Brazil, in both the north and the east. Their origin can be traced to Africa and to the Iberian Peninsula, the sources of most immigration to Brazil during colonial times. It is my impression, from limited knowledge of Brazilian Indians, that few if any of these taboos are of Indian origin.

The food consumption records during two different seasons showed a mild caloric deficiency but an adequate amount of protein, principally of vegetable origin. The supply of the B vitamins and vitamin C seems to be sufficient. A seasonal increase, particularly of riboflavin, appeared in March 1958, mainly because of greater milk consumption.

Iron intake was very satisfactory in groups 1 and 2 and excessively high in group 3 because of a heavy consumption of raw-sugar products. The satisfactory iron intake obviated iron deficiency anemia as a serious problem in spite of the high percentage of infestations of intestinal parasites, particularly hookworm. Such findings support Cruz' thesis (*5*) on the nutritional origin of hookworm anemia. Even the presence of the liver fluke (*Schistosoma*) in 26 percent of the persons examined in group 3 did not seem to have serious consequences in the infested persons as far as the clinical and hematological examination was able to reveal. The generally higher levels of hemoglobin in March 1958 cannot be explained on the basis of higher iron intake or lower infestation rate, because neither of these occurred. The higher intake of ascorbic acid in March 1958 may have had some bearing on this change of hemoglobin levels.

The increase of redness and edema of the periodontium in March 1958 in groups 1 and 2 cannot be explained readily on the basis of nutrition because one might expect the opposite with a higher intake of foods rich in vitamin C.

The intake of vitamin A was low in all three groups during the winter, as shown in July 1957, but there was a seasonal increase during the summer, as shown in March 1958. This same phenomenon was observed with calcium, mainly because of higher consumption of milk and vegetables in March 1958. In spite of this seasonal increase, the intake of calcium and vitamin A remained considerably below National Research Council allowances (*2*). The same observations on calcium and vitamin A have been made in other parts of Brazil (*6*). They seem to be part of a general pattern.

The influence of seasonal supply on the consumption of various fruits, vegetables, and milk (table 7) does not need further comment. For some foods, the considerable differences between the intake based on the 7-day family record and the individual 3-day diet record checked by weighing individual portions pointed to the desirability of getting more individual diet records and also to extending the checking through day-by-day weighing and measuring of the raw foods used by the whole family during 7 days, with the home economist instructing and supervising the housewife during that time. Although more time consuming, this would result in more accurate data on actual food consumption by the family, as has been shown by experienced nutritionists in various countries (*7*).

The mean height of the men in this study was 3 cm. (1.17 inches) more than the mean given for the central area of Brazil by Medonça (*8*), their mean weight being the same. These men were taller than Medonça's mean for 2,281 men in Rio de Janeiro. The women, on the other hand, were 2 cm. (0.78 inches) shorter and somewhat lighter than Mendonça's mean for 653 women. Comparison of the growth of the children of school age at Jequitibá with groups of the same age in Belo Horizonte (*9*) and

Juiz de Fora (*10*), both in the south central area of Minas Gerais, revealed the same phenomenon, at least in the age group 7–12 years; the Jequitibá children were lighter in weight and taller. This made the influence of a racial factor likely.

The families in the three groups showed a remarkable physical similarity. The seasonal variations in physical characteristics which occurred in all of them were striking. The dry, rough skin found as xerosis and follicular hyperkeratosis in July 1957 is usually looked upon as a sign of vitamin A deficiency due to a very low intake of milk, fruits, and vegetables rich in vitamin A or carotene. With the higher intake of foods rich in vitamin A in March 1958, these skin signs diminished greatly. However, such signs as thickening and spots on the conjunctiva of the eye, also ascribed to vitamin A deficiency, did not show the same tendency; they increased slightly. But these eye changes usually respond much more slowly to dietary changes, if they are at all reversible.

The comparison of the food pattern as shown in table 7 brought out some interesting differences: people on the east bank of the river ate much less bread, beef, Irish potatoes, and white sugar than those on the west bank. This might have been due to their greater distance from the center of trade and citylike living in Sete Lagoas, or to the higher cost of these items because of this distance. The people tried to make up for this lack of white sugar by using much more raw sugar, usually homemade, and for the lack of beef by eating more pork, usually home raised.

Endemic goiter, common among the families in all three groups, has been known to exist in Minas Gerais for many generations and has been studied by various authors (*9,11,12*). Viana also studied the soils and the foods grown in these soils, and found their iodine content very low (*13*). Iodine deficiency was probably the main cause of goiter in this area.

Summary, Conclusions, and Recommendations

Fifty-four rural families composed of 419 persons in the County of Jequitibá in the State of Minas Gerais in east central Brazil were studied between July 1957 and March 1958 in a pilot nutritional survey. These 54 families were divided into 3 groups of 18 families each; group 1 consisted of farmers who were receiving technical and financial assistance from ACAR; group 2 farmers got technical but no financial help from ACAR; and group 3 farmers had never received technical or financial assistance. Families in group 1 were superior to those in the other two groups in regard to income, some conditions in their homes (stoves, privies, water filters), planting of vegetables and fruits, and year-round consumption of such foods as milk and beef. Correspondingly, they showed a lower incidence of dryness of the skin (xerosis) in July 1957 than the other two groups.

Since the families in group 1 had been exposed to the educational influence of ACAR technicians for some years, their better situation might be ascribed to this influence. Families in group 2 had been exposed much less to ACAR influence because of much more casual contact with its workers, and families in group 3 had never had contact with ACAR personnel.

Information obtained on their home environment showed the great need for a program of health education for these families. This need is still more accentuated if the high prevalence of intestinal parasites is considered. These infestations will vanish only if there is an intensive campaign of construction of privies; of instruction on washing the hands after a bowel movement, before preparing foods, and before eating; and, finally, of instruction on wearing shoes outside the home. To control schistosomiasis in group 3, the use of water infested with the carrier snail should be prohibited for bathing or washing clothing.

Information on attitudes and taboos in relation to foods points out a serious problem, not confined to this area. The mother, after giving birth, restricts her diet to a few foods instead of eating a greater variety of foods. This happens at the time when the milk that should nourish the new infant is formed. It will not be easy to overcome these taboos because they have existed for many generations. Before an intelligent and effective method to combat them can be found, we need to understand their origin.

The food consumption of these families

showed disharmony in the proportions of the various foods, a situation which is common not only in many areas in Brazil but also in other countries. The diet of these families consisted of an abundance of concentrated carbohydrates, such as rice, manioc meal, macaroni, and sugar, in addition to some meat and dried beans, the principal sources of proteins. There was a lack of vegetables and fruits in general, even though their intake increased from one season to the other.

Clinical examinations in conjunction with the dietary findings can demonstrate clearly to these people that their health will improve with more milk, fruits, and vegetables at the end of summer (March) because of a greater intake of such essential nutrients as calcium and vitamins A and C. Such demonstrations can motivate them to plant more vegetables for their own use during the entire year and to preserve food to be eaten during the winter. They also should learn to use more milk at home, selling less.

In the course of a survey such as this, it becomes obvious that one cannot really separate the conditions of personal hygiene, sanitation, and nutrition because they all influence the level of health. Thus, any program of education executed by ACAR or a similar organization should include these three basic fields. It is also clear that before planning an educational program, a survey should be made. People will respond to such a program only if it is based on their own specific needs.

REFERENCES

(*1*) The National Nutrition Conference. Pub. Health Rep. 56: 1233–1255, June 13, 1941.

(*2*) National Academy of Sciences-National Research Council Food and Nutrition Board: Recommended dietary allowances, revised 1953. NAS-NRC Publication No. 302. Washington, D.C., 36 pp.

(*3*) Kimball, O. P.: Prevention of goiter in Michigan and Ohio. J.A.M.A. 108: 860–864, Mar. 13, 1937.

(*4*) Craig, C. F., and Faust, E. C.: Clinical parisitology. Ed. 4. Philadelphia, Lea and Febiger, 1945, 871 pp.

(*5*) Cruz, W. O.: Pathogenesis of anemia in hookworm disease. Parasite carriers. Relationship between the activity of the helminth and iron deficiency in the genesis of the disease. (Also in Portuguese.) Memorias do Instituto Oswald Cruz 28: 391–486 (1934).

(*6*) Lowenstein, F. W.: Endemic goiter and nutrition. I. A study of some aspects of their relationship in a Brazilian-Amazon Community. II. A followup study of 75 families. Am. J. Clin. Nutrit. 7: 331–348, May–June 1959.

(*7*) United Nations, Food and Agricultural Organization: Dietary surveys, their technique and interpretation. FAO Nutritional Studies No. 4. Washington, D.C., 1949, 108 pp.

(*8*) Mendonça, S. S.: O tipo mediano Brasileiro. Supl. Científico do Bol. Rio de Janeiro, Serviçio de Alimentação e Previdencia Social, 1953.

(*9*) Campos, M. M.: Características biométricas e estado nutritivo de escolares em Belo Horizonte. Série técnica No. 1. Belo Horizonte, Secretaria de Saúde e Assistencia de Minas Gerais, 1952, 107 pp.

(*10*) Castilho, J. J.: Medico-pedagogicas. A inspeção médica escolar em Minas. Rev. Med. Minas 1: 79–82, Sept. 15, 1933.

(*11*) Leite, A. L.: Bócio endêmico e doença de chagas. O Hospital (Rio de Janeiro) 21: 817–832, June 1942.

(*12*) Santos, R. A.: Aspectos do bócio endêmico em Minas Gerais. Thesis presented at the Faculty of Odontology and Pharmacy of the University of Minas Gerais. Belo Horizonte, Brazil, 1952, 87 pp.

(*13*) Viana, J. B.: Bócio endêmico em Minas Gerais. Separata dos anais da Fac. de Med. da Univ. de Minas Gerais (Belo Horizonte) 1: 53–75 (1931).

Signs and Symptoms

of trends in public health

Since 1957, the Russian scientific translation program of the Public Health Service has made available to American scientists complete texts of approximately 5,000 Russian scientific papers, totaling 25,000 pages, and about 13,200 abstracts of such papers. In 1959, 2,300 papers from 84 issues of the 9 leading Russian journals appeared in cover-to-cover translations.

« »

Public health aspects of cancer control are reviewed by Norway's Dr. Karl Evang, director-general of health services, and Dr. Einar Pedersen, director of the cancer registry, in the February 1960 issue of the *Journal of Chronic Diseases*.

« »

In Ohio, the Academy of Medicine in Toledo and health officials organized a community uterine cancer detection program for the entire female population of Lucas County.

More than 110,000 pelvic and cytologic examinations have been made on 47,000 patients. Histologically proved uterine cancer was detected in 430 patients, 275 had clinically suspected cancers, and 155 had clinically occult neoplasms detected primarily by smears.

« »

Logan County, Ohio, through its health department, gives each new mother a form for maintaining her child's complete immunization record. Called "Notification of Birth Registration," the form, when completed, serves to establish the child's immunization status as well as supplying proof of age for school entrance.

Prescriptions for drugs required by its members will be filled at cost by the National Epilepsy League.

« »

Almost 950 persons a month were killed by fire in the United States during 1959, the National Fire Protection Association reports. More than 30 percent of the casualties were children, and more than one-half the estimated total of 11,300 deaths occurred in home fires.

« »

Pennsylvania is making an effort to keep Australian kangaroo meat out of bologna and other foods for human use. The attorney general claims there is evidence that 1,000 tons of "unfit" kangaroo meat has been shipped into the State, and a 2½-ton import is under embargo in Philadelphia. Kangaroo meat does not come under the U.S. Department of Agriculture Meat Inspection Act. Pennsylvania claims the meat is not inspected, properly cleaned, or refrigerated in Australia, and is not identified as kangaroo meat on the label.

« »

Nursing research is discussed in the *Journal of the American Medical Association*, May 7, 1960, by Mrs. Apollonia O. Adams, chief of the Division of Nursing Resources, Public Health Service.

« »

Smallpox cases dropped by more than two-thirds throughout the world, excluding Communist China, during 1959, the World Health Organization reports. About 72,000 cases were reported in 1959, compared with approximately 242,000 cases in 1958.

Harvard will receive $100,000 a year for the next 10 years toward expansion of nutritional research laboratories at its School of Public Health, under a grant from General Foods Corporation.

« »

Intellectual differences between whites and Negroes are caused by continuing socioeconomic influences and are not innate racial characteristics, Ohio State University's Dr. Hilda Knobloch, associate professor of pediatrics, and Dr. Benjamin Pasamanick, professor of psychiatry, stated at the Chicago convention of the American Orthopsychiatric Association. They said, "The dichotomy between the white and nonwhite children occurs particularly in adaptive and language behavior, those areas of behavior most subject to sociocultural influences, while motor behavior, which is more a reflection of neurological status, is essentially unchanged."

« »

Almost 400 million man-days a year are lost to acute upper respiratory infections. There are 142 million acute cases per annum, according to the U.S. National Health Survey, Public Health Service.

« »

The "Citizen Apprenticeship Program" of the AFL–CIO is described as "an adventure in community understanding," designed to encourage high school students to extend their knowledge and participation in the social services of their community.

A pilot program was tested over a 2-year period among six high schools in western Pennsylvania's Shenango Valley. During 1958 and 1959, two groups of 32 high school juniors gave eight Saturday afternoons, three evenings, and a day and one-half of their spring vacation, to observe and discuss local community health, welfare, and recreation services.

A limited number of manuals and other program materials used in the Shenango Valley project was available on a "first come" basis from AFL–CIO Community Service Activities, 9 East 40th Street, New York 16, N.Y.

Death Rates for Coronary Heart Disease in Metropolitan and Other Areas

PHILIP E. ENTERLINE, Ph.D., ARTHUR E. RIKLI, M.D., HERBERT I. SAUER, B.A., and MERTON HYMAN, M.A.

IN 1957 special tabulations of deaths and population were prepared which made possible the computation of death rates for the years 1949–51 by cause, age, sex, race, and county of residence. This paper is a report of death rates for coronary heart disease and for all causes of death in those groupings of counties which made up metropolitan and nonmetropolitan areas of the United States in 1950. (The term "coronary heart disease" is used synonymously with the International List term "arteriosclerotic heart disease.")

Death rates will be shown separately for each of 163 metropolitan areas and for the nonmetropolitan segments of 119 economic subregions. In the 1950 census, a metropolitan area was defined as a county or a group of counties containing at least one city of 50,000 or more persons plus contiguous counties, if essentially metropolitan in character and if socially and economically integrated with the central city. These contiguous counties may be considered as suburban counties. Also in 1950, 119 economic subregions of the United States were identified. These subregions, containing both metropolitan and nonmetropolitan counties and defined without regard to State boundaries, consisted of groups of counties manifesting fairly homogeneous characteristics as to patterns of gaining a livelihood, living conditions, and social and economic problems (*1,2*). The economic subregion has been suggested as a useful unit for the study of geographic differences in mortality (*3*).

Death rates shown here were based upon tabulations prepared by the Biometrics Branch of the National Institutes of Health and the Air Pollution Medical Program from records compiled by the National Office of Vital Statistics. This work is described fully in a publication by the Air Pollution Medical Program (*4*). Death rates are averages for the years 1949–51; they are based upon a 50 percent random sample of deaths from heart disease (ISC 410–443) and strokes (ISC 330–334) and upon a complete count of deaths from all other causes. The population used in computing rates is for the year 1950.

Only death rates for the age group 45–64 will be shown. Observations are confined to this age group because there is some doubt as to the accuracy with which the underlying cause of death can be identified for elderly persons (*5*), and at ages under 45 it was felt that there were too few deaths to make their addition worth while. Deaths in the age group 45–64 are of particular interest from a public health standpoint since this is an age group with a substantial life expectancy.

In describing geographic variations in death rates, only rates for white males will be presented. This is because among females the number of deaths from coronary heart disease is relatively small, with the result that geographic variations in death rates for this cause, for the less populous geographic units, tend to lack significance in the usual statistical sense.

Dr. Enterline is chief, Morbidity and Health Statistics Branch, Division of Public Health Methods, Public Health Service. Dr. Rikli is chief, Heart Disease Control Branch, Division of Special Health Services; Mr. Sauer is a statistician; and Mr. Hyman is a sociologist with that branch.

The geographic patterns in death rates for coronary heart disease for white females were found to be generally similar to those for white males in a previous study (*6*), however, so that the geographic patterns for death rates among males presented here probably roughly describe the patterns in death rates among females.

Because the mean age of persons in the age group 45–64 differs somewhat from one population segment to another, and because death rates are highly correlated with age, some of the geographic variation in death rates for this broad age grouping is due to variation in the age distribution of the populations under consideration. For this reason, all death rates presented in this report for the age group 45–64 have been age adjusted in 10-year intervals by the direct method to the age distribution of the total population of the United States in this age group in 1950.

All Areas

Table 1 shows average annual death rates for white males and females aged 45–64 for the years 1949–51 for center city and suburban counties within metropolitan areas and for nonmetropolitan counties. Death rates varied directly with the degree of urbanization for both males and females. The association was greatest for coronary heart disease but appears for the "other cardiovascular diseases" grouping and for the "all other causes" grouping. For coronary heart disease, male death rates in center city counties were 37 percent higher than in nonmetropolitan counties; female death rates in center city counties were 46 percent higher than in nonmetropolitan counties.

Nonmetropolitan Areas

Figure 1 shows the geographic pattern, by quartiles, in death rates for coronary heart disease for white males aged 45–64 in the nonmetropolitan segments of 116 economic subregions. Three of the total 119 economic subregions have only metropolitan areas. Metropolitan areas are shown in black and are not included in the quartile distribution. Since metropolitan areas constitute only a small proportion of the total land area of the United States, variation in their death rates does not lend itself to the same kind of graphic presentation as does variation in death rates for nonmetropolitan areas.

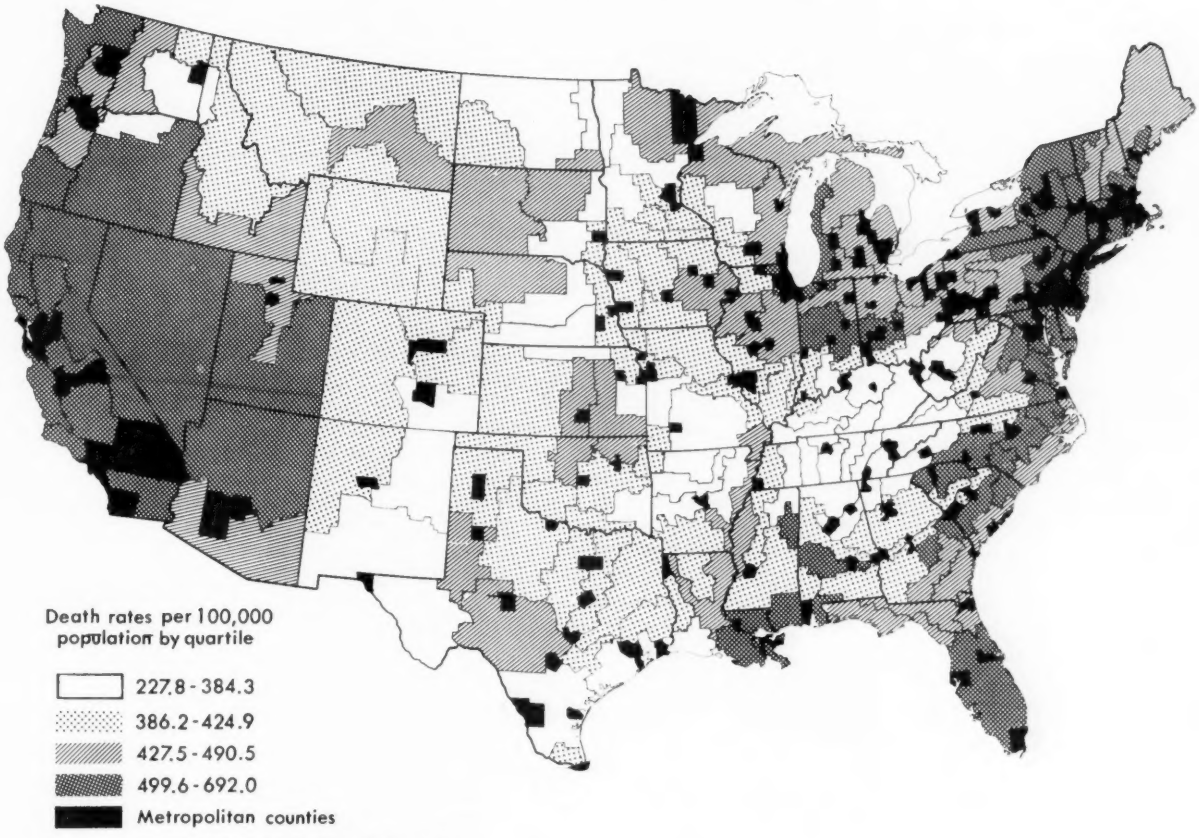
The key to figure 1 shows that death rates for the nonmetropolitan segments of economic subregions varied considerably. The subregion with the highest death rate had a rate over three times as high as the subregion with the lowest death rate. Contiguous economic subregions had similar death rates. High mortality rates were confined largely to a strip of territory near the South Atlantic coast

Table 1. Annual death rates per 100,000 population, by degree of urbanization, selected causes, whites aged 45–64, United States, 1949–51 [1]

Cause of death [2]	Males			Females		
	Metropolitan areas		Nonmetropolitan counties	Metropolitan areas		Nonmetropolitan counties
	Center city counties	Suburban counties		Center city counties	Suburban counties	
All causes	1,730.5	1,505.3	1,374.9	943.6	894.4	786.4
Cardiovascular diseases (330–334, 400–468)	935.3	832.2	735.7	430.9	413.1	345.0
Coronary heart disease (420)	606.1	542.7	442.5	176.8	162.2	120.8
Other cardiovascular diseases	329.2	289.5	293.2	254.1	250.9	224.2
All other causes	795.2	673.1	639.2	512.7	481.3	441.4

[1] Age adjusted in 10-year intervals.
[2] Figures in parentheses refer to International List numbers.

Figure 1. Coronary heart disease death rates for 116 economic subregions, nonmetropolitan areas only, white males aged 45–64, 1949–51



NOTE: Age adjusted in 10-year intervals.

stretching from Delaware to central Georgia, much of the Northeastern and Great Lakes regions, the Mississippi River Delta, and much of the area west of the Rockies. Low death rates for coronary heart disease were prevalent throughout most of the area between the Rockies and the Mississippi and in an area west of the Appalachian Mountains. Generally, the geographic pattern corresponds to that observed when, in a previous study, States were used as units for analysis (*6*).

Figure 2 shows the geographic pattern in death rates for nonmetropolitan areas for all causes of death for white males in the age group 45–64. Geographic variations in "all cause" death rates seem relevant to the study of coronary heart disease death rates since they probably strongly reflect geographic variations in coronary heart disease. They cannot, however, be influenced by any differences in diagnostic standards which might exist in various sections of the country, an important consideration in studying coronary heart disease mortality. An effect of coronary heart disease on the "all cause" death rate is suggested by the fact that in 1950 over a third of all deaths among white males aged 45–64 were assigned to coronary heart disease, and if death rates for coronary heart disease truly varied they would be expected to influence death rates for all causes (*7, 8*).

Variations in death rates pictured in figure 2 are sufficiently like those in figure 1 to provide some assurance that geographic variations in coronary heart disease death rates similar to those shown in figure 1 truly existed around 1950 and were not simply the result of variations in diagnostic criteria.

Metropolitan Areas

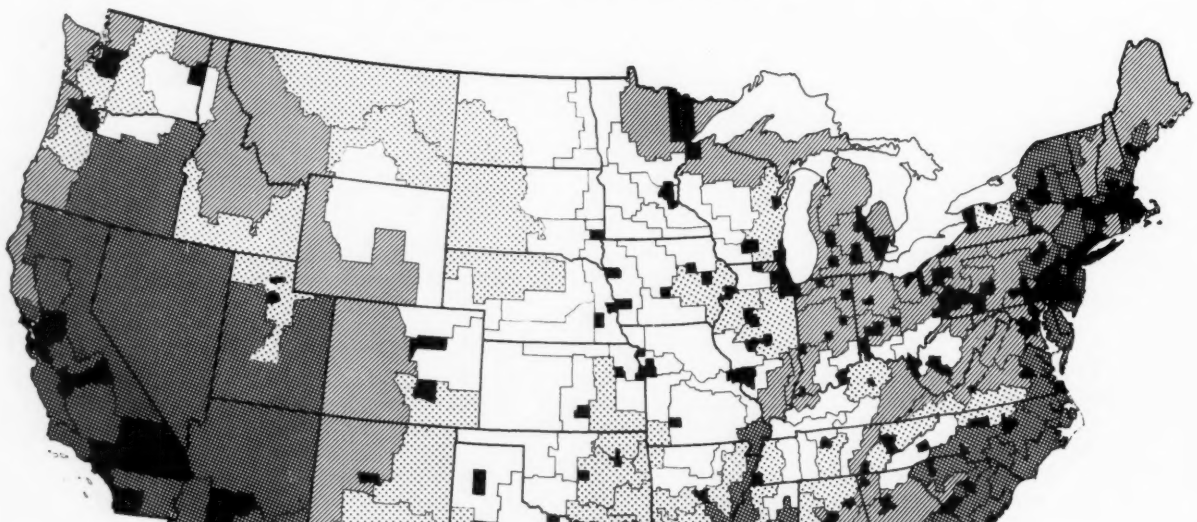
Table 2 shows death rates for coronary heart disease and for all causes of death for white

males aged 45–64 for each of the 163 metropolitan areas in the United States, and the rank of each metropolitan area in relation to all other metropolitan areas. Thus, a rank of 140 means that 139 areas had higher death rates, while 23 had lower death rates. A rank of 7 means that only 6 areas had higher death rates and 156 had lower death rates.

In Bureau of the Census publications, 168 standard metropolitan areas are used. In this report, in order to define metropolitan areas as groupings of counties, it was necessary in New England to combine certain metropolitan areas as defined by the Bureau of the Census. Also, the New York-Newark-Jersey City standard metropolitan area was divided into two areas, New York and Newark-Jersey City. For a further account of these redefinitions see the publication by Manos (*4*).

Metropolitan areas with coronary heart disease death rates which differed significantly from the unweighted mean for all metropolitan areas ($P<.05$) are noted, to assist the reader in determining whether a particular city in which he may be interested had an unusual death rate. Coronary heart disease death rates for metropolitan areas varied considerably, ranging from 826.8 in Savannah, Ga., to 299.0 in Lincoln, Nebr. Contrasts were great even for metropolitan areas in fairly close proximity. In Pennsylvania, for example, the death rate among middle-aged white males in Harrisburg was 607.8 while in Lancaster it was only 438.7. The corresponding "all cause" death rates in Harrisburg and Lancaster were 1,594.1 and 1,370.4, respectively. In California, the coronary heart disease death rate was 730.6 in Sacramento and 467.6 in San Bernardino; in Washington, 615.8 in Seattle and 461.6 in Spokane; in South Carolina, 825.6 in Charleston and 602.2 in Columbia; in Alabama, 517.6 in Birmingham and 349.8 in Gadsden.

Figure 2. Death rates for all causes for 116 economic subregions, nonmetropolitan areas only, white males aged 45–64, 1949–51



NOTE: Age adjusted in 10-year intervals.

Coronary heart disease death rates for metropolitan areas varied geographically in about the same manner as death rates shown in figure 1 for nonmetropolitan areas. There were some exceptions, however. In Florida, while coronary heart disease death rates in nonmetropolitan areas were generally high (fig. 1), rates for metropolitan areas were about average. The coronary heart disease death rate for white males aged 45–64 for the nonmetropolitan portion of the economic subregion which occupies central and southern Florida was 550.4 per 100,000 population, while for metropolitan Orlando it was 512.9; for Tampa and St. Petersburg, 560.3; and for Miami, 646.5.

A lack of contrast between metropolitan and nonmetropolitan counties also appears in economic subregions located in Wisconsin, Illinois, and Indiana. In a few economic subregions the death rates in the nonmetropolitan portions were actually higher than in the metropolitan portions. Boston, Brockton, Fall River, and

Table 2. Death rates per 100,000 population for coronary heart disease and for all causes, white males aged 45–64, 163 metropolitan areas, United States, 1949–51

Metropolitan area	Coronary heart disease		All causes		Metropolitan area	Coronary heart disease		All causes	
	Rate[1]	Rank	Rate[1]	Rank		Rate[1]	Rank	Rate[1]	Rank
Akron, Ohio	[2] 491. 5	132	1, 436. 7	133	Durham, N.C	541. 3	101	1, 501. 8	115
Albany-Schenectady-Troy, N.Y	[3] 725. 5	7	1, 844. 9	18	El Paso, Tex	[2] 441. 5	148	1, 789. 1	24
Albuquerque, N. Mex	[2] 389. 1	157	1, 510. 5	111	Erie, Pa	594. 5	56	1, 754. 1	30
Allentown-Bethlehem-Easton, Pa	588. 6	61	1, 560. 8	98	Evansville, Ind	547. 5	96	1, 647. 7	68
Altoona, Pa	601. 6	50	1, 640. 7	72	Fall River-New Bedford, Mass	[3] 626. 5	26	1, 729. 4	36
Amarillo, Tex	483. 7	136	1, 564. 1	93	Flint, Mich	601. 7	49	1, 527. 0	108
Asheville, N.C	486. 1	134	1, 431. 8	135	Fort Wayne, Ind	571. 0	76	1, 497. 3	118
Atlanta, Ga	570. 1	77	1, 646. 8	70	Fort Worth, Tex	630. 9	25	1, 552. 9	101
Atlantic City, N.J	578. 6	68	1, 728. 1	37	Fresno, Calif	507. 5	123	1, 702. 5	44
Augusta, Ga	693. 2	13	1, 991. 0	8	Gadsden, Ala	[2] 349. 8	162	1, 473. 0	127
Austin, Tex	475. 7	140	1, 424. 6	137	Galveston, Tex	[3] 802. 1	3	1, 981. 5	9
Baltimore, Md	[3] 598. 1	54	1, 864. 4	16	Grand Rapids, Mich	571. 0	75	1, 439. 6	132
Baton Rouge, La	[3] 720. 6	8	1, 681. 2	55	Green Bay, Wis	[2] 400. 7	155	1, 251. 1	159
Bay City, Mich	[2] 438. 3	150	1, 686. 7	53	Greensboro-High Point, N.C	521. 6	113	1, 412. 9	139
Beaumont-Port Arthur, Tex	553. 0	93	1, 638. 2	73	Greenville, S.C	[3] 692. 2	14	1, 848. 7	17
Binghamton, N.Y	612. 8	36	1, 600. 6	83	Hamilton-Middletown, Ohio	568. 2	79	1, 560. 9	97
Birmingham, Ala	517. 6	117	1, 676. 8	56	Harrisburg, Pa	607. 8	39	1, 594. 1	84
Boston, Mass	[3] 606. 0	42	1, 690. 4	50	Hartford, Conn	573. 3	73	1, 548. 5	103
Bridgeport, Conn	[3] 618. 3	30	1, 573. 6	90	Houston, Tex	521. 1	114	1, 694. 9	45
Brockton, Mass	553. 2	92	1, 476. 0	124	Huntington, W. Va.–Ashland, Ky	[2] 433. 5	151	1, 523. 6	109
Buffalo, N.Y	[3] 612. 9	35	1, 808. 4	20	Indianapolis, Ind	615. 8	33	1, 738. 2	35
Canton, Ohio	[2] 472. 3	141	1, 431. 3	136	Jackson, Mich	493. 4	131	1, 486. 1	120
Cedar Rapids, Iowa	468. 4	142	1, 307. 5	156	Jackson, Miss	634. 4	22	1, 769. 5	26
Charleston, S.C	[3] 825. 6	2	2, 254. 2	1	Jacksonville, Fla	579. 9	65	1, 754. 0	31
Charleston, W. Va	592. 0	59	1, 761. 7	28	Johnstown, Pa	527. 6	110	1, 657. 9	62
Charlotte, N.C	[3] 696. 6	12	1, 554. 6	100	Kalamazoo, Mich	576. 7	69	1, 378. 8	150
Chattanooga, Tenn	576. 7	70	1, 702. 8	43	Kansas City, Mo	564. 1	85	1, 610. 0	82
Chicago, Ill	574. 4	72	1, 868. 4	15	Kenosha, Wis	537. 3	104	1, 450. 7	131
Cincinnati, Ohio	574. 5	71	1, 750. 1	33	Knoxville, Tenn	[2] 460. 8	145	1, 570. 0	92
Cleveland, Ohio	[3] 625. 6	29	1, 747. 4	34	Lancaster, Pa	[2] 438. 7	149	1, 370. 4	151
Columbia, S.C	602. 2	48	1, 727. 0	38	Lansing, Mich	598. 5	53	1, 401. 8	143
Columbus, Ga	603. 4	46	1, 913. 4	12	Laredo, Tex	405. 5	154	1, 979. 4	10
Columbus, Ohio	528. 5	109	1, 562. 2	96	Lexington, Ky	[2] 364. 9	159	1, 389. 0	146
Corpus Christi, Tex	563. 6	86	1, 617. 6	79	Lima, Ohio	483. 8	135	1, 393. 7	145
Dallas, Tex	[3] 633. 2	23	1, 562. 5	95	Lincoln, Nebr	[2] 299. 0	163	1, 135. 4	163
Davenport, Iowa-Rock Island-Moline, Ill	569. 1	78	1, 419. 7	138	Little Rock-North Little Rock, Ark	611. 2	37	1, 622. 1	78
Dayton, Ohio	605. 6	44	1, 477. 9	123	Lorain–Elyria, Ohio	534. 4	106	1, 647. 7	67
Decatur, Ill	547. 5	97	1, 473. 8	125	Los Angeles, Calif	[3] 679. 1	15	1, 684. 2	54
Denver, Colo	527. 0	111	1, 563. 5	94	Louisville, Ky	551. 7	94	1, 689. 4	51
Des Moines, Iowa	514. 4	119	1, 501. 7	116	Lubbock, Tex	[2] 399. 6	156	1, 211. 4	161
Detroit, Mich	563. 4	87	1, 661. 2	61	Macon, Ga	564. 4	83	1, 995. 5	7
Duluth, Minn.–Superior, Wis	578. 8	67	1, 508. 9	112	Madison, Wis	[2] 458. 1	146	1, 315. 8	153

Footnotes at end of table.

(Continued on p. 764)

Table 2. Death rates per 100,000 population for coronary heart disease and for all causes, white males aged 45–64, 163 metropolitan areas, United States, 1949–51—Continued

Metropolitan area	Coronary heart disease		All causes		Metropolitan area	Coronary heart disease		All causes	
	Rate[1]	Rank	Rate[1]	Rank		Rate[1]	Rank	Rate[1]	Rank
Manchester, N.H	602.8	47	1,670.4	57	San Bernardino, Calif	[2] 467.6	143	1,483.6	121
Memphis, Tenn	584.1	63	1,766.9	27	San Diego, Calif	572.7	74	1,612.2	81
Miami, Fla	[3] 646.5	20	1,647.9	66	San Francisco–Oakland, Calif	[3] 639.4	21	1,802.1	21
Milwaukee, Wis	[3] 604.3	45	1,633.1	74	San Jose, Calif	605.6	43	1,506.6	113
Minneapolis–St. Paul, Minn	537.2	105	1,458.2	129	Savannah, Ga	[3] 826.8	1	2,080.8	6
Mobile, Ala	599.9	51	1,631.9	75	Scranton, Pa	586.0	62	2,085.0	5
Montgomery, Ala	707.3	9	1,883.5	14	Seattle, Wash	[3] 615.8	32	1,689.0	52
Muncie, Ind	665.3	17	1,517.3	110	Shreveport, La	599.1	52	1,542.7	104
Nashville, Tenn	[2] 477.4	139	1,623.3	76	Sioux City, Iowa	626.3	27	1,652.2	64
Newark–Jersey City, N.J	564.2	84	1,717.5	40	Sioux Falls, S. Dak	558.8	91	1,385.8	148
New Haven, Conn	568.1	80	1,649.9	65	South Bend, Ind	563.0	88	1,461.8	128
New Orleans, La	[3] 747.4	5	2,099.7	4	Spokane, Wash	[2] 461.6	144	1,478.2	122
New York, N.Y	[3] 677.4	16	1,751.6	32	Springfield, Ill	632.3	24	1,780.6	25
Norfolk–Portsmouth, Va	[3] 753.7	4	1,795.1	23	Springfield, Mo	539.9	102	1,431.8	134
Ogden, Utah	504.2	126	1,311.6	155	Springfield, Ohio	662.5	18	1,582.8	87
Oklahoma City, Okla	516.7	118	1,578.1	88	Springfield–Holyoke, Mass	606.1	41	1,589.8	85
Omaha, Nebr	566.7	81	1,502.9	114	Stockton, Calif	617.8	31	1,979.0	11
Orlando, Fla	512.9	120	1,622.7	77	Syracuse, N.Y	610.3	38	1,644.5	71
Peoria, Ill	518.4	115	1,533.3	107	Tacoma, Wash	506.6	124	1,408.2	141
Philadelphia, Pa	[3] 613.9	34	1,801.1	22	Tampa–St. Petersburg, Fla	560.3	89	1,666.4	60
Phoenix, Ariz	[2] 422.7	153	1,904.3	13	Terre Haute, Ind	531.1	108	1,754.8	29
Pittsburgh, Pa	[3] 595.5	55	1,693.5	47	Toledo, Ohio	580.3	64	1,691.0	48
Pittsfield, Mass	559.2	90	1,647.0	69	Topeka, Kans	493.4	130	1,258.3	158
Portland, Maine	[3] 699.5	11	1,693.9	46	Trenton, N.J	579.1	66	1,706.7	42
Portland, Oreg	538.0	103	1,537.1	106	Tulsa, Okla	550.9	95	1,572.2	91
Providence, R.I	593.2	58	1,666.5	59	Utica-Rome, N.Y	546.8	99	1,588.6	86
Pueblo, Colo	[2] 357.5	161	1,217.9	160	Waco, Tex	[2] 372.7	158	1,306.5	157
Racine, Wis	518.2	116	1,380.7	149	Washington, D.C	[3] 607.7	40	1,690.9	49
Raleigh, N.C	626.2	28	1,667.7	58	Waterloo, Iowa	480.7	138	1,388.9	147
Reading, Pa	522.7	112	1,560.8	99	Wheeling, W. Va.–Steubenville, Ohio	512.1	122	1,614.8	80
Richmond, Va	[3] 706.5	10	1,843.5	19	Wichita, Kans	543.1	100	1,495.2	119
Roanoke, Va	512.7	121	1,408.6	140	Wichita Falls, Tex	446.6	147	1,203.8	162
Rochester, N.Y	[3] 652.2	19	1,540.3	105	Wilkes-Barre–Hazelton, Pa	593.7	57	2,225.0	2
Rockford, Ill	503.9	127	1,399.8	144	Wilmington, Del	590.1	60	1,653.8	63
Sacramento, Calif	[3] 730.6	6	2,150.2	3	Winston-Salem, N.C	547.0	98	1,549.1	102
Saginaw, Mich	506.6	125	1,450.8	130	Worcester, Mass	533.0	107	1,473.3	126
St. Joseph, Mo	482.8	137	1,402.3	142	York, Pa	499.5	128	1,356.6	152
St. Louis, Mo	[2] 498.3	129	1,711.9	41	Youngstown, Ohio	565.6	82	1,575.4	89
Salt Lake City, Utah	491.0	133	1,500.4	117					
San Angelo, Tex	[2] 357.8	160	1,315.6	154					
San Antonio, Tex	[2] 429.9	152	1,723.7	39					

[1] Age adjusted in 10-year intervals. [2] Significantly below average at 0.05 level. [3] Significantly above average at 0.05 level.

New Bedford, Mass., and Providence, R. I., all have lower death rates than the nonmetropolitan portion of the economic subregion they occupy. In Texas, the Lubbock metropolitan area had a coronary heart disease death rate for white males 45–64 of 399.6 while the corresponding death rate for the nonmetropolitan portion of the economic subregion it occupies was 472.7; San Angelo had a rate of 357.8 while in the remainder of the economic subregion it occupies the rate was 427.5; Pueblo, Colo., had a death rate of 357.5 as compared with 360.7 for the remainder of its subregion; and Albuquerque, N. Mex., had a death rate of 389.1 compared with 401.8 for the remainder of its subregion.

As was true for nonmetropolitan segments of economic subregions shown on figures 1 and 2, there is a correlation between death rates for coronary heart disease and death rates for "all causes." Metropolitan areas ranking high or low in their coronary heart disease death rate

tend to rank correspondingly high or low in their "all cause" death rate; the rank order correlation coefficient is 0.60.

Discussion

Relatively high death rates in urban areas were among the earliest of demographic observations. The reasons for this for noninfectious diseases such as coronary heart disease are not clearly known. Some of the urban-rural differentials in mortality previously reported may have been due to errors in the residence classification of death certificates. However, such errors are probably not an important factor in differences in death rates between metropolitan and nonmetropolitan areas. It is believed that any errors in residence classification probably take place mainly between urban and rural parts of metropolitan areas rather than between metropolitan and nonmetropolitan areas (*9*). Nor does it seem likely that contrasts in death rates for coronary heart disease between metropolitan and nonmetropolitan areas are due solely to variations in diagnostic criteria, in view of the contrasts observed in death rates for all causes.

Possibly even more significant than the association of coronary heart disease mortality with urbanization are the geographic differentials in death rates which cannot be accounted for by urbanization. These may be due to artifacts such as under- or over-enumeration of population, under-registration of deaths, or misstatement of age either in the 1950 census or on death certificates; or they may be the result of differentials in factors which cause coronary heart disease.

It might be productive to study metropolitan areas in relation to the mortality data presented here. Metropolitan areas seem to be particularly appropriate units for study since they constitute natural ecologic units, basically similar while relatively independent. There may also be natural units within some of the larger metropolitan areas which would form a useful basis for analysis (*10*).

Nonmetropolitan areas, as defined in this report, might also prove to be productive units for analysis. A previous study of variations in mortality for all causes of death among rural counties in the United States suggested that the percentage of the population employed in agriculture explained much of the variation, particularly at ages over 40 (*11*). Occupational variables might be importantly involved in geographic distributions of mortality from coronary heart disease presented here, not only among nonmetropolitan areas but among metropolitan areas as well; or possibly some climatic or geological factors are involved. There are, in fact, many hypotheses relating to etiological factors in coronary heart disease which might be profitably tested by a study of factors associated with mortality rates in various segments of our population (*12*).

Summary

In the United States during the years 1949–51 the resident death rates for coronary heart disease among white persons aged 45–64 varied directly with the degree of urbanization for both males and females. In metropolitan counties with center cities, coronary heart disease death rates were 37 percent higher for males and 46 percent higher for females than in nonmetropolitan counties.

Coronary heart disease death rates in the nonmetropolitan segments of 116 economic subregions varied considerably, with the highest rate being over three times the lowest. High mortality areas were confined largely to a strip of territory near the South Atlantic coast stretching from Delaware to central Georgia, much of the northeastern and Great Lakes regions, the Mississippi River Delta region, and much of the area west of the Rockies. There was a similar geographic pattern in death rates for all causes.

Death rates for coronary heart disease for 163 metropolitan areas of the country also varied considerably and followed much the same geographic pattern as death rates for nonmetropolitan areas. In a few sections of the country there was, however, little difference in coronary heart disease death rates between metropolitan and nonmetropolitan areas.

Contrasts in death rates for coronary heart disease among metropolitan areas were found to be great for some metropolitan areas in fairly close proximity.

A parallel between death rates for coronary

heart disease and death rates for all causes suggests that the variations in coronary heart disease death rates noted here were probably not simply the result of differences in diagnostic criteria in various sections of the country.

REFERENCES

(*1*) Bogue, D. J.: Economic areas as a tool for research and planning. Am. Soc. Rev. 15: 409–416, June 1950.

(*2*) Bogue, D. J., and Beale, C. L.: Economic subregions of the United States. Farm population. Series Census—BAE, No. 19. Washington, D.C., U.S. Government Printing Office, June 1953.

(*3*) Dorn, H. F.: Some problems for research in mortality and morbidity. Pub. Health Rep. 71: 1–5, January 1956.

(*4*) Manos, N. E.: Comparative mortality among metropolitan areas of the United States. PHS Pub. No. 562. Washington, D.C., U.S. Government Printing Office, 1957.

(*5*) Starr, I.: Heart disease as a cause of death. Circulation 16: 1–2, July 1957.

(*6*) Enterline, P. E., and Stewart, W. H.: Geographic patterns in deaths from coronary heart disease. Pub. Health Rep. 71: 849–855, September 1956.

(*7*) Keys, A.: Atherosclerosis: A problem in newer public health. J. Mt. Sinai Hosp. 20: 118–139, July-August 1953.

(*8*) Sauer, H. I., and Enterline, P. E.: Are geographic variations in death rates for the cardiovascular diseases real? J. Chronic Dis. 10: 513–524, December 1959.

(*9*) U.S. National Office of Vital Statistics: Vital Statistics of the United States, 1950. Washington, D.C., U.S. Government Printing Office, 1954, vol. 1, p. 153.

(*10*) Kent, A. P., McCarroll, J. R., Schweitzer, M. D., and Willard, H. N.: A comparison of coronary artery disease (arteriosclerotic heart disease) deaths in health areas of Manhattan, New York City. Am. J. Pub. Health 48: 200–207, February 1958.

(*11*) Woolsey, T. D.: An investigation of low mortality in certain areas. Pub. Health Rep. 64: 909–920, July 22, 1949.

(*12*) Stamler, J.: The epidemiology of atherosclerotic coronary heart disease. Post Grad. Med. 25: 610–622, 685–701, May, June 1959.

Report to the People

In the 1959 report of the health department of Peoria, Ill., printed in pocket size on coated paper, the frontispiece carries a sketch of the new city health center. An informal greeting, of 250 words, by Dr. Fred P. Long, director of health, is followed by eight pages of pictures of the department in action, including press and television work, classes for expectant parents, inservice training, counseling by public health nurses of mothers and the aged, school health, followup of accidental poisoning, clinics, history recording and filing, sanitation, laboratory and dental services, rabies control, and a deep bow to the clerical staff restoring their mental health over a cup of coffee.

One page with six brief paragraphs is given to current achievements, such as a conference on emotional health in the schools and the reduction of the number of outside toilets to 26 in a community which had 3,300 when the health department was organized. The facing page looks to the future, with three items, set up in news-page form, referring to an air pollution report, a survey of the effects of fluoridation in the city, and a continuing program of immunization.

The last page carries the local vital statistics, with a breakdown of leading factors in death and illness, and a financial statement. The inside back cover lists the names, jobs, and locations of all employees of the department. The back cover says: "Scientific progress is based on the art of knowing the changing wants and needs of the people."

George Hensley, director of health education, lists himself in alphabetical order under administration.

Philadelphia's program in the control of accidental poisonings delineates possible guidelines for other metropolitan areas with similar resources and interest. The National Clearinghouse for Poison Control Centers serves as a consulting and coordinating agency for such programs throughout the country.

Control of Accidental Poisoning in Philadelphia

EMIL A. TIBONI, B.A., M.P.H.

THE TELEPHONE rang at the Philadelphia Poison Information Center. The man on duty lifted the receiver. A woman on the line pleaded tearfully, "My baby has just swallowed a mouthful of paint remover! What should I do?"

Swiftly, the duty officer determined exactly what had been taken and the amount; the age, sex, and weight of the victim; and the necessary information to permit followup of the case. All the facts were recorded on an especially designed form which served as both a checklist and a record. The card file and the selected texts of the extensive reference library containing definite information on more than 20,000 products were consulted.

The mother was then given instructions. "Have your child sip ice-cold orange juice or ice water to prevent vomiting and delay absorption. He should have medical attention immediately. Don't be alarmed but take him to your nearest hospital right away. Do you have transportation? Your husband has the car? Then get ready to leave and we will have a police car pick you up right away. What hospital will you go to? We will call to say that you are coming in. The police car will be at your home right away."

A call to the police department dispatcher sent a car to call for the mother and child. Another call was put to the emergency ward of the hospital to give notice of the case coming in and the physician in charge was given information on the composition of the product and treatment recommended in data at the center. The hospital's special treatment facilities, necessary medicinals, and supplies made preparations possible before the arrival of the child. Prompt treatment was given and the child recovered completely.

This case represents the services performed every day by the Poison Information Center in Philadelphia. The center is an important and dramatic service designed to assist the medical and lay members of the community to make maximum use of the precious minutes which lie between the occurrence of the poisoning accident and the beginning of the poisoning injury. Rapidity and severity of injury vary according to the substance ingested and other factors, but in most accidents, there is some time which can be used to prevent or reduce injury or save a life.

In more difficult cases, the center calls for the

Mr. Tiboni is chief, community hygiene section, division of environmental health, Department of Public Health, Philadelphia, Pa.

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services of one or more of the volunteer members of five panels of consultants or the chief toxicologist of the office of the medical examiner. When information on composition of a product is not available in the community, a call is placed to the manufacturer for discussion with the company toxicologist or other appropriate person.

Poison control is an integral part of the accident control program of the Philadelphia Department of Public Health. Within this framework, accidental poisonings are regarded as simply another type of accident to be controlled by all available means.

Control of accidents is conducted comprehensively in the department's program as well as in depth. Ideally, the objective is to prevent the occurrence of the accident. Primary concern, however, is to prevent or minimize possible injury, if an accident does occur. The need for rehabilitation of persons sustaining accidental injuries is also recognized. All of these stages of control are the concern of the department.

To meet these needs, an extensive interdisciplinary public health and community effort has been developed over the past several years. Responsibility for the planning, development, and direction of poison control rests with the accident control program which is centered in the community hygiene section of the division of environmental health. Poison control functions are conducted by various divisions of the department having necessary resources, through agreement reached between the respective divisions and the director of the accident control program. For example: A coordinating committee composed of heads of the cooperating divisions reviews special questions or problems encountered in the operation of poison control activities. Personnel and other resources contributed by the respective divisions are provided presently through use of funds budgeted to the respective divisions. Proposals supported by the committee have requested allocation of specific funds for poison control to the accident control program which would in turn allocate necessary funds to cooperating divisions according to program needs.

Community contributions of services are received directly from individuals, hospitals, and professional organizations, and the Greater Philadelphia Safety Council.

One of the most important community activities is the system of poison control coordinators. At the request of the poison control program director, a member of the staff of each general and children's hospital of the city was designated by the hospital administrator to work with the health department in furthering the control of accidental poisonings. Usually, the person designated is a physician having substantial responsibility in the hospital. In some cases, an upper level administrator is designated. Responsibilities of the poison control coordinators include liaison with the poison control program, staff education, supervision of reporting of cases treated at the hospital, and development of emergency treatment techniques and facilities to the maximum extent possible in their respective hospitals.

Initial impetus for the program came from the Philadelphia Pediatric Society which requested the health department to establish a poison control program and offered its assistance for this purpose. In the autumn of 1955, an advisory committee was formed to review the department's plans and to develop specific program proposals which could be supported by the entire community. In addition to several pediatricians and other specialists representing their respective societies and the five medical schools of the city, the committee included representatives of a variety of other organizations concerned with potentially poisonous substances. These included the Manufacturing Chemists Association, American Pharmaceutical Association, American Industrial Hygiene Association, Eastern Pennsylvania Pest Control Association, American Chemical Society, Philadelphia Association of Retail Druggists, and a staff representative of the Philadelphia Department of Public Health.

The program as ultimately evolved represents a balance between prevention and efforts to minimize the consequences of accidental poisoning. Relative emphasis can be expected to vary as possibilities for different types of action are developed. Actions taken locally to minimize consequences are the establishment of the poison information center and the well-developed emergency treatment facilities available in most

hospitals. Preventive measures include follow-up of each reported case, statistical and epidemiological analysis, education, consultation, and proposed legislation. The potential for research into effects of certain substances and the management of selected cases is inherent in the program but no specific projects are currently underway. Such research is already an important function of the National Clearinghouse for Poison Control Centers, Public Health Service, to which statistical data from the Philadelphia program are provided.

Minimization of Consequences

In recognition of the existing and expected occurrence of numerous cases of accidental poisoning, considerable effort has been expended in the development of facilities to minimize the consequences of these accidents.

The term "accidental poisoning" as used in this program does not imply the evaluation of substances involved, with the establishment of some minimum level of toxicity before the substance is included. The term signifies the ingestion of a nonedible substance or the inhalation or other exposure to a substance which is believed to present some toxic hazard.

The Poison Information Center was the first operative part of the program because of this apparent need. In addition, it was recognized that the emergency information service would be a dramatic concrete activity through which attention could be focused on poisoning hazards. A further consideration was that cooperation in reporting of cases by hospitals would be enhanced by first providing them with such a service.

The Poison Information Center is at present located in the office of the medical examiner, a branch of the department of public health. It is under the technical supervision of the chief toxicologist. Information is given in emergencies on a 24-hour-a-day basis to anyone who telephones. Calls, answered by investigators from the staff of the medical examiner, are received on a direct incoming telephone line equipped with a distinctive bell commanding immediate attention. The telephone number of the Poison Information Center, WAlnut 2–5524, has been widely publicized. Through the cooperation of the Bell Telephone Company of Pennsylvania, this number is listed in the "emergency calls" section of the Philadelphia and other southeastern Pennsylvania telephone directories.

The center gives full information regarding toxic ingredients, symptomatology, and recommended treatment measures to physicians and hospitals. Information to lay persons is limited to first-aid measures and a suggestion for immediate referral to a hospital or family physician, according to the seriousness of the case. It is felt that information on first-aid measures can be limited in an urban community where professional attention at a hospital is available within a few minutes in any area of the city. By alerting the hospital in advance, the net time before treatment is further reduced.

Use of a standard telephone inquiry form (see form) permits uniformity in handling and

REPORT OF TELEPHONE INQUIRY
CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH

DATE RECEIVED AT P.I.C.

MATERIAL *(Poison)* INVOLVED: *NATURE AND AMOUNT*

NAME OF VICTIM	AGE	SEX	WEIGHT
ADDRESS	PHONE		
NAME OF CALLER	RELATIONSHIP		
ADDRESS OF CALLER	PHONE		

ACTION TAKEN BY PERSON ANSWERING PHONE. OTHER REMARKS

DATE OF ACCIDENT	TIME OF ACCIDENT A.M. P.M.	PERSON RECEIVING INQUIRY

REFERRAL INFORMATION *(For A.P.U. Use Only)*

DATE RECD. FROM P.I.C.	DATE REF. TO H.D.	REFERRED TO HEALTH DISTRICT
PERSON		REFERRED BY

a written record of each case. This form also serves as a report to the central office.

In addition to the card file, an extensive reference library, and the services of the chief toxicologist of the office of the medical examiner, noted above, five panels of professional consultants may be called if necessary for additional guidance on therapy, composition of pharmaceuticals, household products, or pesticides and the effects produced by the bites or stings of poisonous plants and animals.

Recommendations are offered to the city hospitals by the poison control program on organization of treatment facilities, and the equipment, supplies, and medicinals, which are desirable. The emergency treatment facilities of Philadelphia General Hospital, a branch of the health department, have been fully developed with the cooperation of the hospital staff and the American College of Apothecaries. These facilities serve both as a model to other hospitals and as a source of emergency supplies and medicinals. Items required only on unusual occasions have been located and arrangements for immediate procurement at any hour have been made. This includes a complete supply of snake antivenin, which is supplied to Philadelphia General Hospital by the Philadelphia Herpetological Society or which is available through local pharmaceutical houses. All local hospitals providing emergency service have been supplied with a list of recommended items and an indication of where they may obtain them if needed in an emergency.

In the event that a hospital requires an item in an emergency, the poison information center advises where it can be obtained and arranges delivery by the police department, if necessary. The hospital is required to replace or pay for the item within a reasonable time.

Arrangements to make supplies and medicinals available on emergency loan have recently been broadened to provide this service to any community in the Nation. Commercial air carriers have volunteered to give shipments expeditious handling, and the Pennsylvania Air National Guard has offered to fly emergency missions. These requests will be handled in the same manner as requests from Philadelphia hospitals except that delivery will be made to the Philadelphia International Airport. If

schedules and the nature of the emergency permit, the required item is carried on a commercial flight. In cases of great urgency, transportation is arranged by a chartered flight or by the Air National Guard.

Prevention

Efforts in prevention begin with a followup investigation by public health nurses of each reported case. The poison information center forwards to the accident control office a duplicate copy of the "Report of Telephone Inquiry" form. The hospitals of the city and surrounding areas complete and forward an especially designed "Report of Poisoning" form, which also gives information on the substance involved and clinical data.

Each case involving a resident of the city is immediately referred to the health district where the victim lives. An investigation is made within 5 days of the accident. Cases involving residents of other communities are re-

ferred to the local or State health department office having jurisdiction.

The public health nurse completes a "Follow-Up Investigation of Poisoning" form, and evaluates the environment and the family situation, providing advice accordingly. If indicated, the nurse will continue to assist the family. Her final report is also submitted to the accident control program where it is reviewed, coded, and collated with other reports on the case.

Currently, approximately 1,000 cases per year are being investigated. Investigations are made only when the exposure appears to have been accidental or the circumstances are not clear. Exposures involving suicidal or homicidal intent are excluded. Apparent suicide attempts are referred to the division of mental health for possible action in suicide control efforts.

Lead poisoning is regarded as a separate program activity because of the differences in etiology and control measures involved. Cases of lead poisoning, when reported, are investigated by other personnel through a different set of procedures. Also, control measures are developed and applied separately from those of accidental poisoning.

After coding and collation, all forms received on each case are transferred by accident control personnel to the division of statistics and research where the data are recorded on machine punchcards, and tabulated periodically. Tables prepared are similar to those recommended by the National Clearinghouse for Poison Control Centers. It is hoped that continuing evaluation of the data on hand and opinions of those closely concerned with the program will provide increasing epidemiological insight through selective additional cross tabulations and possible modifications of followup reports.

Although specific data are regarded as essential to successful education, certain educational efforts have been made on the basis of

preliminary findings and empirical judgment. These efforts have been primarily promotional, to call attention to the seriousness of the problem and the resources available in an emergency.

Some public education has been accomplished by distribution of several hundred thousand copies of a leaflet entitled, "Accidental Poisoning: How To Prevent It: What To Do If It Occurs." The press, television, radio, and exhibits have been used. A limited number of talks have been given to community groups. Excellent cooperation has been received from a number of local groups, including the local chapter of the American Society of Safety Engineers, the Health and Welfare Council, Philadelphia Hospital Pharmacists Association, and local telephone officials.

Proportionately more emphasis has been given to presenting and developing the subject with various medical, nursing, and public health groups, where contacts are extensive and the program is well known. Requests for information are common.

A major effort in professional education has just been completed in the form of a full-day symposium on accidental poisoning. We hope to publish the proceedings. Those attending included the poison control coordinators and various other groups having professional or business interest in accidental poisonings, as typified by the original advisory committee.

Broader public education efforts have been delayed pending development of additional local data. While the need for even more epidemiological data is recognized, the extensive data already produced make it possible, we believe, to begin an ambitious plan of action. This plan contemplates the participation of each of the various disciplines of the department having central or health district contacts with public and professional groups.

It is recognized that certain control legislation is desirable, and data to support such legal controls are being gathered. It appears advisable, however, that legislation should be enacted by as large a political jurisdiction as possible, as long as the standards it establishes meet local needs. Design and maintenance standards in dwellings appear to be an important area for possible local legislation at this time.

Evaluation

Evaluation of the operation of the program is a continual process conducted by the director and staff of the program with the assistance of the intradepartmental coordinating committee composed of the directors of cooperating divisions.

There is widespread and enthusiastic support in the community and an unquestioning acceptance of the hazards of accidental poisoning. This is in sharp contrast to the attitude displayed toward certain other types of accidents. Using the criterion of public acceptance, it appears that this has been a proper and adequately conducted program.

There seems to be little doubt that the poison information center should be under medical supervision. This is especially true of the actual dispensing of information. Despite the fact that it is clear to the caller that the person answering the telephone inquiry is not a physician, there is still some question of liability. In many instances a physician calls and there appears to be a desire on his part to discuss the case with the person providing the information. It appears preferable that first-aid information to parents or other lay callers be given under guidance of a physician.

Preparation of information cards and other steps to review and organize data for dispensing are now handled well at the center under supervision of a competent toxicologist, but nevertheless specific medical review and approval of each recommendation would be of considerable value.

There is a need for more intensive effort in analysis and interpretation of followup and hospital-reported data. Current statistical resources are competent but limited. In addition, there is need for continuing interpretation by personnel specifically charged with epidemiological analysis of this subject. More attention should be focused also on areas of research in the management of cases and the relative effect of a variety of substances on human beings, as opposed to empirical determinations or findings with experimental animals.

Attention by physicians and hospitals to accidental poisoning has grown steadily. Only additional time and effort is required to bring

additional knowledge, as it is obtained, to their attention.

The cost of this program is not measured readily because its activities are almost entirely absorbed by various cooperating divisions. However, estimates based on a careful review of personnel time and materials indicate that approximately $55,000 per year is being used.

There is ample evidence, from surveys conducted by the American Academy of Pediatrics, from morbidity data and reported cases in Philadelphia, and from other statistics, to indicate that accidental poisoning is a major problem and that it is likely to continue to increase markedly unless effective preventive measures are applied. There can be little doubt that the emergency information given to more than 2,400 persons per year who were sufficiently alarmed to call the poison information center represents an important and valuable public service. Similarly, the emergency treatment of victims of accidental poisoning undoubtedly continues to improve as a result of the continuing exchange of ideas among the poison control coordinators of the various hospitals and our staff. It also appears that injuries from accidental poisonings can be reduced more readily than injuries from most other types of accidents.

The emergency information given, improvements in emergency treatment of cases, increased attention by both physicians and the general public, substantial data gathered for analysis, and general community mobilization are all regarded as useful contributions to the community welfare.

Plans for the Future

It is hoped that the program may expand. One proposal, if accepted, would provide for an answering service 24 hours each day staffed by graduate nurses under supervision of a public health physician.

The establishment of an ad hoc committee of members of the professional community is planned to study the question of research into the toxic effects of certain substances and management and rehabilitation of cases, and to propose specific research studies.

The only major forecast is a change from the present followup of all reported cases to a selective followup procedure, after data have been accumulated for another 2 or 3 years.

Summary

The Philadelphia Department of Public Health conducts a poison information center which provides emergency information on the composition of over 20,000 trade name products and the treatment recommended if accidentally taken. Consultation in emergency and nonemergency situations is provided by a toxicologist and five panels of consultants to the program. The telephone number has been listed in the "emergency calls" section of the telephone directories of the area, as a public service by the telephone company.

Each hospital has appointed a poison control coordinator who is responsible for liaison with the program, staff education, and supervision of reporting of cases to the health department. Well-developed special treatment facilities exist in most of the hospitals of the city and immediate suburbs. Emergency transportation of victims to hospitals is provided by the police department. An inventory of rare or unusual drugs, supplies, and equipment has been prepared. The location of these items is recorded at the poison information center and has been supplied to each hospital. Special arrangements for emergency transportation of needed items have been made with the police department. Required items will also be transported by plane to any point in the Nation through the cooperation of the commercial airlines and the Pennsylvania Air National Guard.

Public health nurses conduct a home investigation of each reported case. Data on the case, including clinical history, are provided by the hospitals. These data are analyzed and interpreted statistically and epidemiologically. Cooperation with the National Clearinghouse for Poison Control Centers is maintained.

Public and professional education is conducted through mass media, wide associations with professional and civic groups, and by specially prepared materials, including exhibits and leaflets.

NOTE: The author will supply, upon request, copies of the various forms and literature used in the program.

Federal Publications

The Membrane Filter. *PHS Publication No. 749; 1960; 20 pages; 20 cents.*

A teaching aid to supplement the filmstrip "The Membrane Filter," this booklet provides instruction on how to use the filmstrip. It contains black and white copies of the pictures appearing in the film and the full text of the sound record which accompanies the filmstrip.

These pictures and text illustrate and describe the use of the membrane filter technique for bacteriological analysis of water. Also included is information on how to obtain loan copies of the filmstrip with sound recording and other visual aids for water supply training.

Directory of State and Territorial Health Authorities. *PHS Publication No. 75; revised 1960; 104 pages; 35 cents.*

Health department personnel of each State and Territory are listed so as to reflect the organizational pattern of the department. Preceding the listing of health department officials is a listing of all State and Territorial Health officers, showing the title, headquarters address, and telephone number of each health department.

Similar information is shown for State agencies other than health departments administering grant programs of the Public Health Service and the crippled children's grant program of the Children's Bureau.

Sanitation Facilities for Indians. What does P.L. 86–121 mean to you? *PHS Publication No. 735; 1960; 6 pages.*

Designed primarily for Indian and Alaskan Native beneficiaries of the Public Health Service and their tribal leaders, this leaflet highlights the scope of projects and the requirements for participation under the Indian Sanitation Facilities Act (P.L. 86–121, approved July 31, 1959.)

Through questions and answers, the Public Health Service's authority to assist Indians in the construction of domestic and community water supplies, waste disposal, and other sanitation facilities is explained. Emphasis is placed on the participation of Indians in all phases of project development and construction, including assumption of their responsibilities for operation and maintenance.

Summary of NIH Research Programs in Aging, 1959. *PHS Publication No. 740; 1960; 16 pages; 15 cents.*

Research in aging carried out or supported by the National Institutes of Health during calendar year 1959 is briefly reported.

Divided into sections on intramural and extramural activities, the booklet discusses research in three broad areas: (1) biological process of aging; (2) chronic diseases associated with the aged; and (3) additional health-related problems. Special attention is given to studies conducted by the Section on Aging, National Institute of Mental Health, and the Gerontology Branch, National Heart Institute, and lists of papers and publications by their staff members are included.

Statistical summaries of extramural research are also presented.

Community Health Program Materials. Selected references. *PHS Publication No. 783; 1960; 59 pages.*

More than 250 references to selected materials produced primarily by the Bureau of State Services, Public Health Service, are listed.

Intended for use by State and local health departments and voluntary health agencies, the materials include guides to organizing and administering public health programs, recommendations for standards and codes, vital and health statistics, and health information for the public.

Some of the items will be of value in training and orienting employees new to public health programs; others, in presenting new knowledge in areas receiving increasing program emphasis such as chronic diseases and health of the aged, radiological health, air and water pollution, health mobilization, and accident prevention.

Fertility Tables for Birth Cohorts of American Women. Part I. Annual and cumulative birth rates, by age, by order of birth for all women in cohorts of 1876 to 1943. *Vital Statistics—Special Reports; Selected Studies; vol. 51, No. 1; Jan. 29, 1960; by Pascal K. Whelpton and Arthur A. Campbell; pages 1–129.*

Tables of annual and cumulative birth rates present various measures of fertility for actual groups of women from their 14th to their 50th birthday. The accompanying text explains the cohort fertility concept and methodology and describes the changes in cohort birth rates. It also gives examples of uses of cohort fertility rates.

The data presented are important in interpreting short-run changes in fertility as measured by conventional period rates, in assessing the effect of these changes on cumulative fertility and family size, and in making birth projections.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.